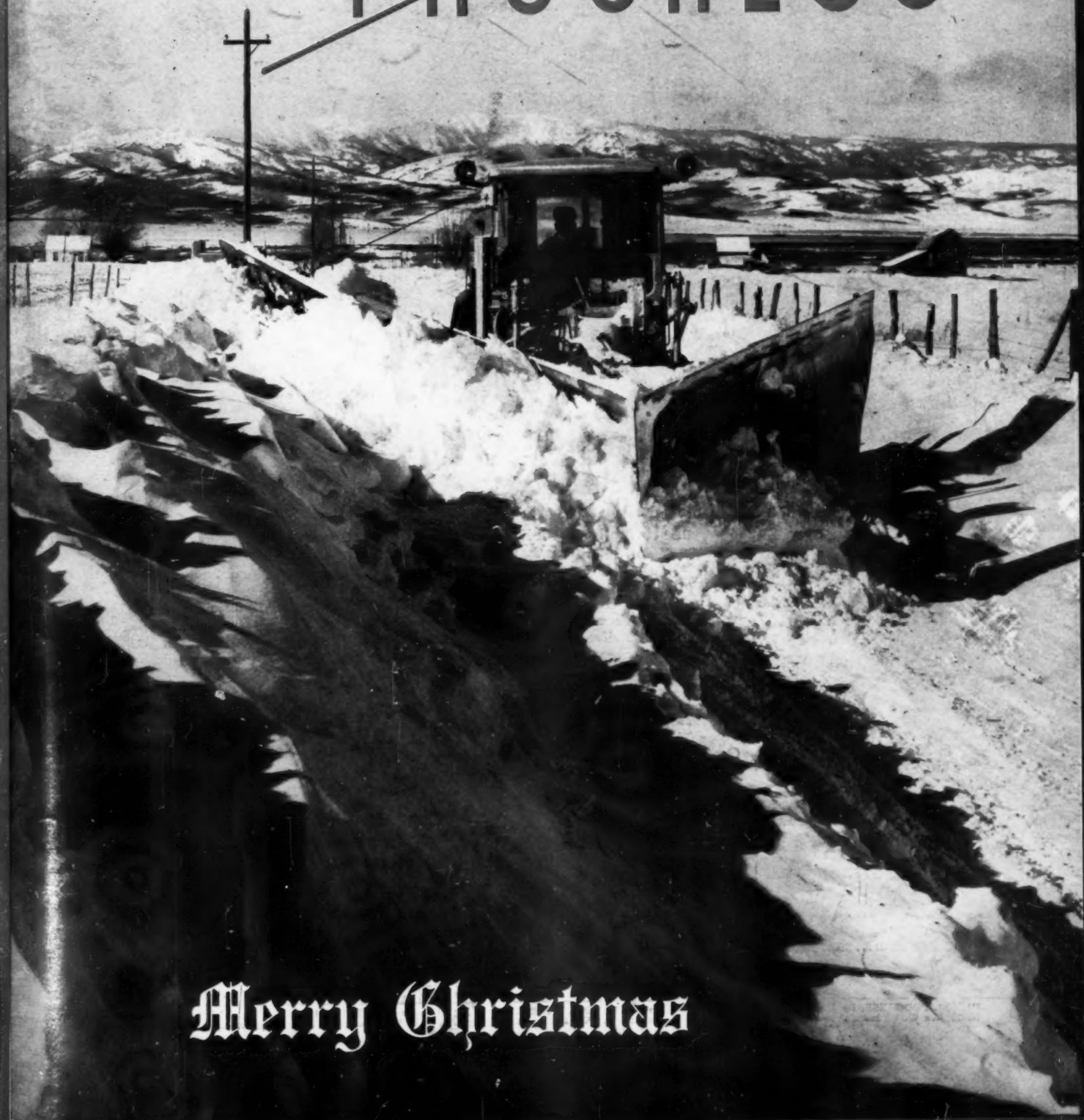
DIESEL PROGRESS



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DIESEL and GAS ENGINE PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

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DECEMBER 1947

FRONT COVER ILLUSTRATION: Caterpillar Diesel motor grader with snow plow clears away drifts near west entrance to Teton Pass in Idaho at 7,000 ft. elevation with temperature below zero.

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Diesel Trucks Thrive In Southwest Desert Country

Under grueling desert conditions Cummins-engined Sterling hauls 45-ton transformer on 32-wheel trailer. Three desert detours were required on haul from Henderson, Nevada, to Parker Dam because bridges would not stand load.

By WILFRED H. LUSHER

THE highways of the Southwestern United States, where drivers encounter temperature variations of nearly 100 degrees in a few hours, provide one of the most grueling tests of truck engines in the country.

Temperatures over the desert run as high as 125 degrees, making fast schedules imperative when the cargo includes perishable freight. It is on hauls like these, and on hauls where fast schedules with heavy payloads mean additional profits, that Diesel has come into its own.

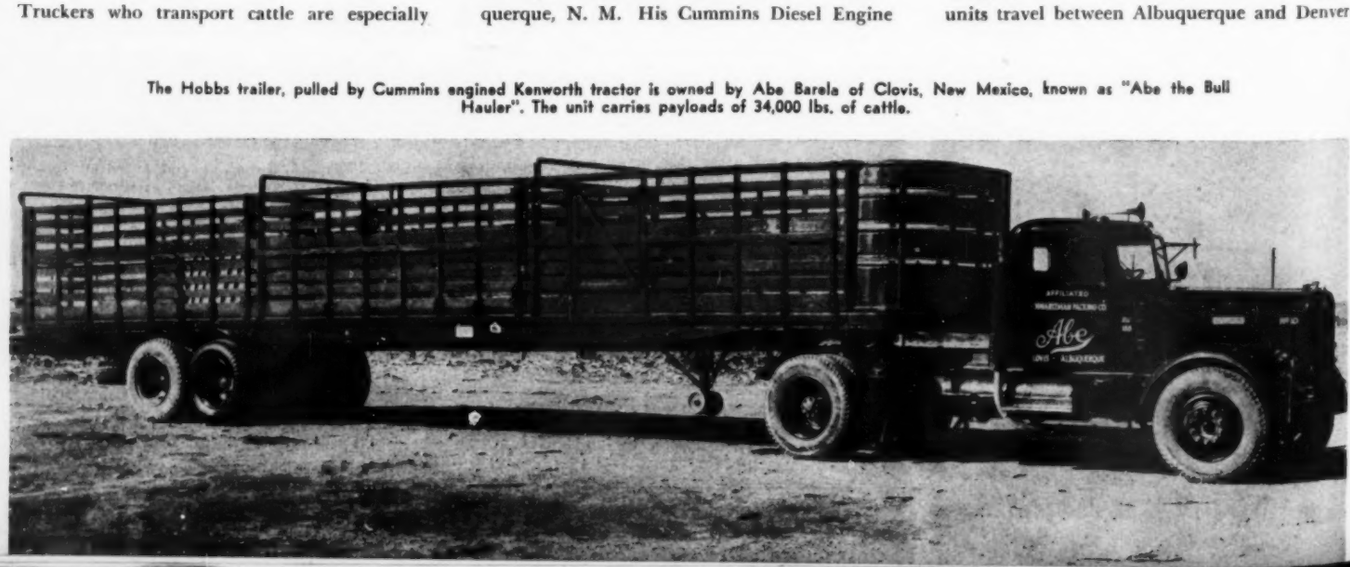
Truckers who transport cattle are especially eager to make fast trips over desert highways. A few extra hours in the broiling sun may result in a sharp decrease in the weight of the animals. With today's high livestock prices, every pound of weight lost reduces profits considerably.

An excellent example of cattle haulers who have turned to Diesel is Abe Barela of Clovis, N. M., known through the Southwest as "Abe the Bull Hauler." His Cummins-powered tractor pulls a 47-foot Hobbs trailer. Barela carries payloads of 34,000 pounds, making as many as 52 trips a month between Clovis and Albuquerque, N. M. His Cummins Diesel Engine operated 178,000 miles before it was taken down for an overhaul.

Transportation of perishable goods is only one of the fields in which Southwest operators have proved the superior efficiency and economy of Diesel. Diesels have won important recognition in all types of highway freighting.

An outstanding example of a general haulage operation that has turned to Diesel power is the Los Angeles-Albuquerque Express, Inc. This company has 16 Cummins-powered units. Eight units travel between Albuquerque and Denver

The Hobbs trailer, pulled by Cummins engined Kenworth tractor is owned by Abe Barela of Clovis, New Mexico, known as "Abe the Bull Hauler". The unit carries payloads of 34,000 lbs. of cattle.



and the other eight run to Los Angeles. Drivers make the 831-mile run to Los Angeles in 23 to 26 hours. They put nearly 15,000 miles per month on the units. Fuel consumption figures show an average of approximately 4.5 miles per gallon of Diesel fuel.

This run from Albuquerque to Los Angeles provides an excellent example of the temperature conditions encountered in this part of the country. Drivers have seen the outside temperature vary as much as 90 degrees within four hours. On this run, too, altitude conditions differ greatly. Truck engines are forced to operate in the heavy pressures below sea level, and, a few hours later, as high as 7,500 feet, where the air is thin.

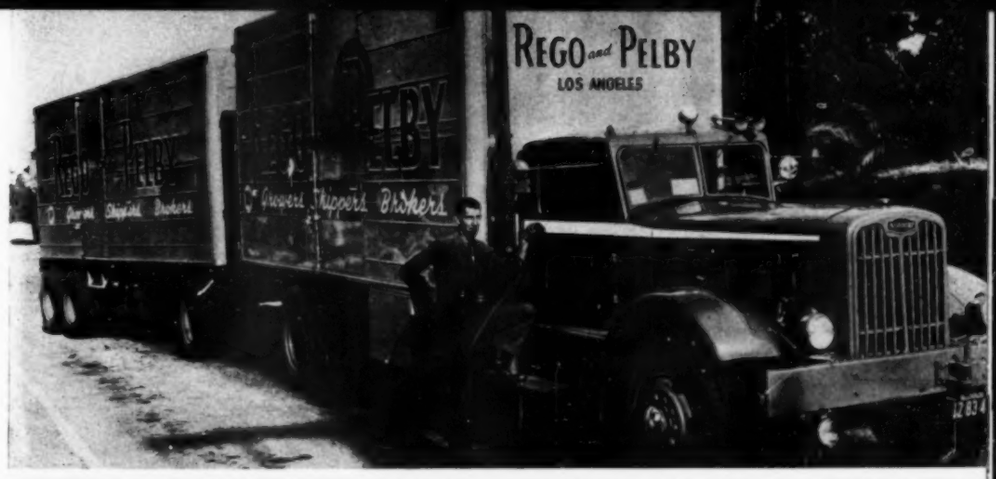
The Santa Fe Trail Transportation Company of Albuquerque also runs to Denver and Los Angeles, using 17 Cummins Diesel units. Division Superintendent C. H. Crutcher praises these Diesels highly, pointing out that "they haul freight cheaper and faster, have more power and haul larger loads."

The Mimbres Valley Gin Company of Deming, N. M., uses its Cummins-powered Kenworth tractor to haul cottonseed cake and cattle. Company officials report that the Diesel-powered rig is 14 hours faster on the 750-mile trip to Los Angeles than gasoline-powered units.

Diesels have demonstrated their versatility in numerous other varieties of highway hauling in this area. The McNutt Oil and Refining Company of El Paso, Tex., for instance, has three Cummins-powered tank trucks that have rolled up outstanding mileage records on the run between El Paso and Phoenix, Ariz. The three units, powered with Cummins Diesels, have traveled well over 5,000,000 miles, with each truck accumulating close to 20,000 miles per month.

Lumber hauling is an important business in the Southwestern states and Diesels won acceptance in the field many years ago. The New Mexico Timber Company of Bernalillo, N. M., for example, operates seven Cummins-powered units. Loads of 25,000 feet are handled with ease by units powered with Model NHB-600 Cummins Diesels.

These companies, and others pictured on these pages, are only a few of the Southwestern Diesel operators who have found they can maintain faster schedules, cut fuel costs, and count on more dependable service when their power source is a Diesel engine.



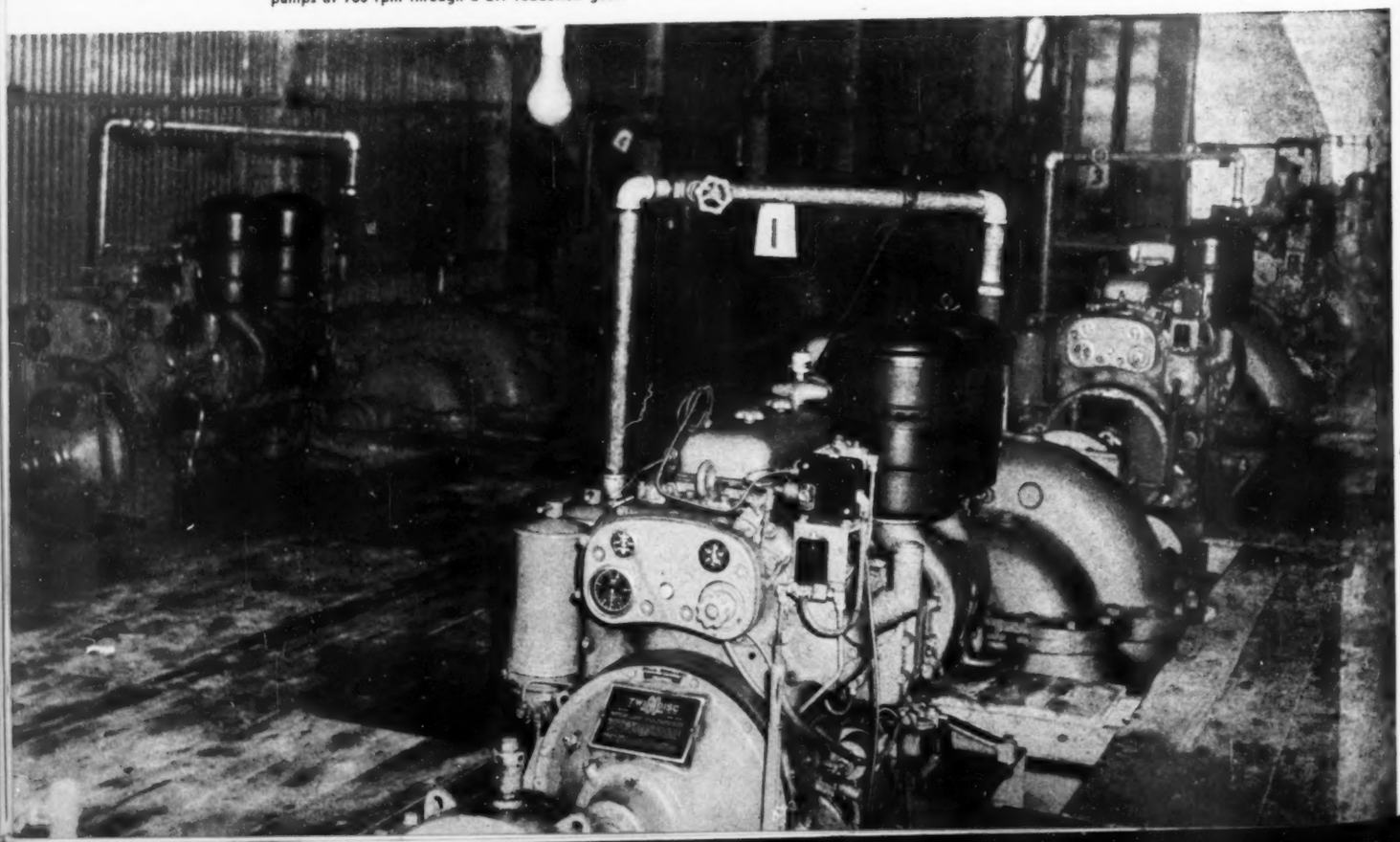
Top photograph, above—Autocar truck-trailer combination hauls perishable goods from Yuma, Arizona, to Los Angeles markets. Below—Santa Fe Trail Transportation Company operates six of these Peterbilt-Cummins engined tractor-trailers on Denver-Albuquerque run over 8,150-foot Raton Pass.

Cummins-engined Mack operated by the Navajo Freight Lines operates over the mountains to Denver and Los Angeles seen below. Bottom illustration shows Diesel engined International "Western" truck used to transport cattle to Los Angeles Stockyards from Arizona.

View of Long Mott pumping station where water from Goff Bayou is raised 24 ft. to canal system.

DIESELS BY THE DOZEN

View of Diesels at Long Mott station. They drive 8800 gpm Allis-Chalmers centrifugal pumps at 700 rpm through a 2:1 reduction gear.



Ten 6-cylinder General Motors Diesels installed in pump house operate 24 hours a day during irrigation season.

Serve the Calhoun County Canal Company

By DOUGLAS SHEARING

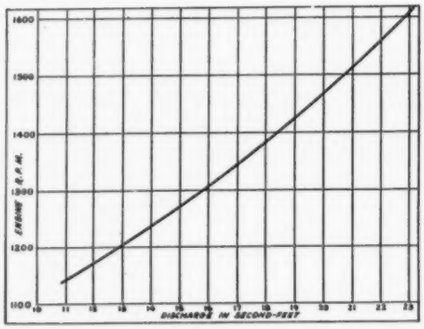
ABOUT fifteen miles west of Port Lavaca, Texas, there is a river, the Guadalupe, which carries plenty of water and floods the lowlands occasionally and with its overflow feeds a couple of big lakes, Mission Lake and Green Lake, the latter lying upstream. And just east of the river bottom and the two huge lakes, the land rises sharply and then levels off into a long and wide plain, stretching east to Port Lavaca and south to the Gulf. This land is rich, excellent farm land, able to grow anything provided the moisture were there, and for many years back the old-timers were always figuring how wonderful life could be if they could just persuade the waters of Green and Mission Lakes to run uphill for just a little ways so they could water those thousands of acres of black soil lying just out of reach.

Well, today the water of those lakes and the Guadalupe does run uphill for just a little ways. Then it flows into about 45 miles of canals and makes many a farmer happy, thanks to the Calhoun County Canal Company and General Motors Diesels. Might as well give Allis-Chalmers pumps credit for an assist, too. The Calhoun County Canal Company, a corporation with headquarters in Port Lavaca, Texas, is in its first year of operation. The president of the corporation is Charles G. Hooks, of Houston, Texas; Victor W. Bouldin is secretary and treasurer, and the vice-president and general manager is C. S. Clark.

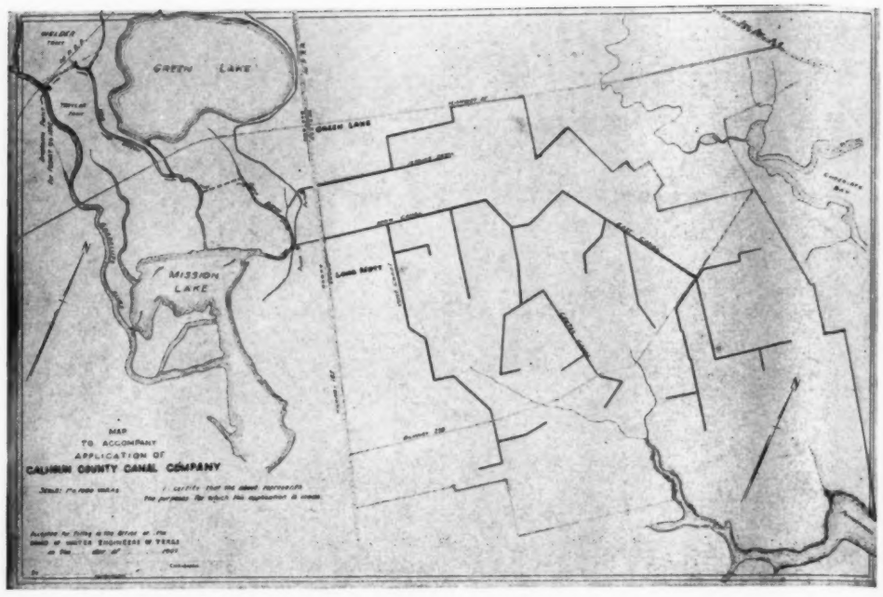
The corporation, explains Mr. Clark, has a permit from the State of Texas to irrigate 25,000 acres out of a 50,000 acre tract. The limitation of 50% is placed to save the land; rice cannot be grown every year on the same ground or very soon nothing at all will grow there, and Texas proposes to protect its farmers even against themselves; if they cannot get water except on alternate years, rice will only be grown on a proper schedule and the soil will retain its quality.

This first year the corporation placed 13,000 acres under irrigation. This land is not owned by the corporation; it is owned by the men who farm it. Neither does the corporation own the water; the State of Texas owns the water, giving the corporation permission to use it, transporting it and selling it to the landowners handy to its canal system.

Farmers are charged by the corporation at the rate of $10.00 per acre, the service entitling them to all the water their farms need for irrigation for the season. A farm generally uses about a million gallons per acre, says Mr. Clark, though with his engineer's training he calls it three acre-feet; one acre-foot is 326,000 gallons. A rule of thumb for rice-growing needs, accord-



Curve showing pump discharge vs. engine speed for average Diesel at Long Mott pumping station. Pitot tube measurements were used.



(Right) Map showing area served by the Calhoun County Canal Company System. It covers a 50,000 acre tract.

ing to Mr. Clark, is about ten gallons per minute per acre—quite a flow.

Ordinarily irrigation will commence about the first of April; this year, operations did not commence until the first of June, continuing until along in September. Rice alone was irrigated this year. For future operations, Mr. Clark hopes to institute a seasonal irrigation system, a year-round service to farmers so they can utilize water for diversified farming and get full value from their land. Cotton farmers as well as rice growers are calling for irrigation and will use water as soon as it can be made available for them; they could not be served at the beginning of the corporation's career but Mr. Clark hopes to aid them in the near future. There is no doubt whatever of the sureness of the water supply. The accompanying map shows the corporation's canal system, its proximity to the bayou connecting Mission and Green Lakes, and also emphasizes the size of the lakes. As the Quadalupe is no small river, plenty of water for irrigation is a sure thing.

From Goff Bayou to the reservoirs on the higher ground there is a static lift of twenty-four feet. To run this water uphill in volume there are two pumping stations; the larger one downstream, near Long Mott shown on the map and a smaller one near the Green Lake section. The lower station uses a battery of ten six-cylinder General Motors Diesels, each connected through a 2:1 ratio reduction gear to an 8800 gpm 16 in. Allis-Chalmers centrifugal pump; the pumps are turned at 700 rpm. There is no special equipment on the Diesels in the way of filters or other accessories; they are straight factory jobs as supplied through Stewart and Stevenson Services, G-M distributors of Houston.

Usual practice, Mr. Clark points out, is to run all the engines all the time, 24 hours a day during the irrigating season, 7 days a week. "And sometimes," he adds significantly, "we wish we had some more engines and pumps to hook up!"

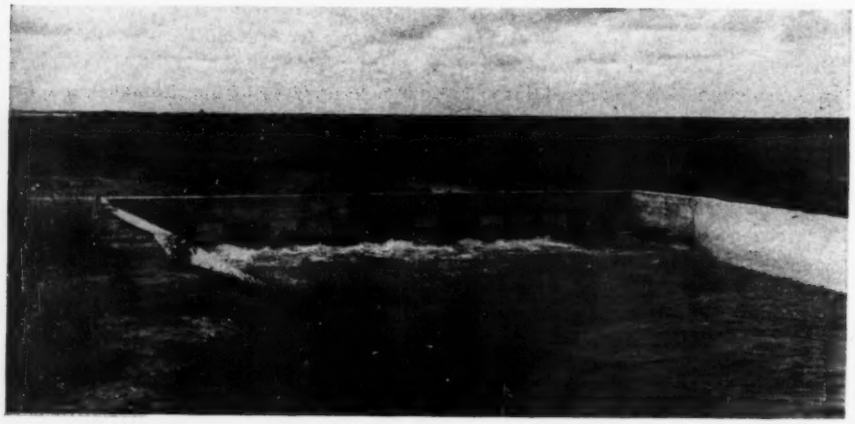
The pumping station higher up on Bayou Goff is a smaller plant; here there are three more General Motors 6-cylinder Diesels, two of which are hooked to the same size and type of pumps as used at the lower station, the third Diesel pulling a 24 in. vertical pump.

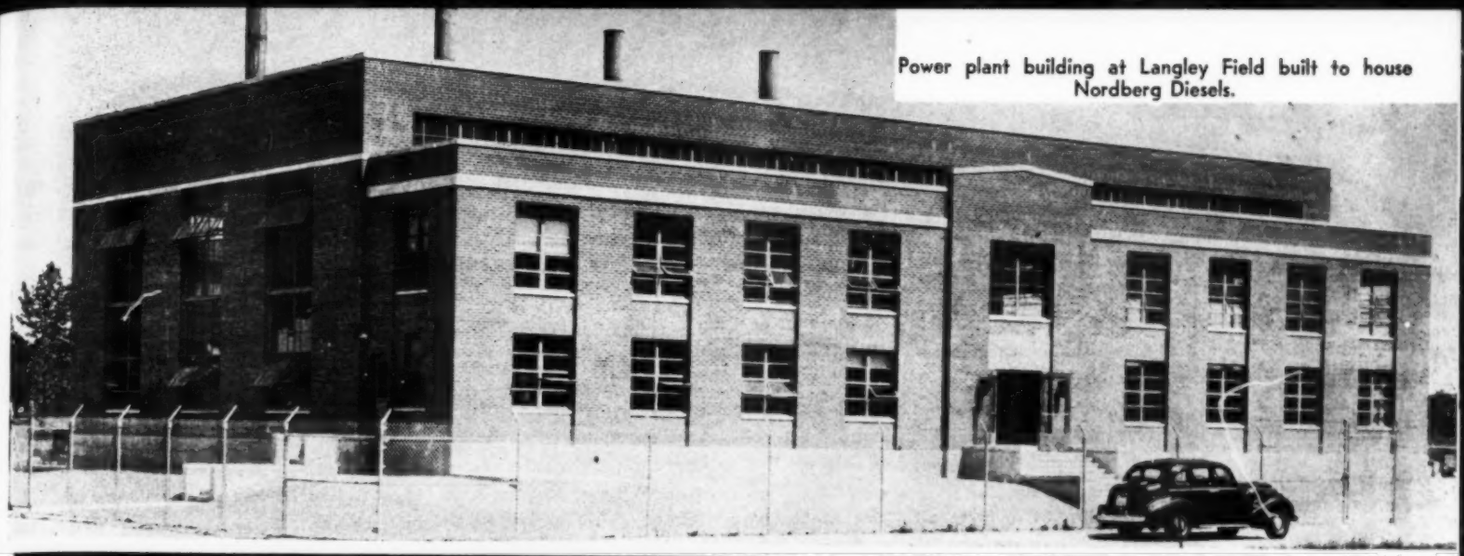
"These General Motors Diesels are doing a fine job," says Mr. Clark; "they are working very nicely in every way and not giving a particle of trouble. I'll admit that I kind of favored the older design, slower speed Diesels but these G-M's are surprising. We wanted to see what they would stand; if they were going to break up, we wanted to know it before we were in the middle of the irrigating season, so we gave the engines a thorough testing, not at 1400 rpm. but at 1600."

The corporation is now serving around thirty farms; the farmers are pleased indeed with adequate irrigation water and the corporation is receiving many calls for irrigating additional acreage. If his firm is to accommodate this demand for more water, says Mr. Clark, it will mean an increase in pumping capacity, either more engines and more pumps or bigger engines and bigger pumps. Whichever angle he decides to use to get the additional water for more crops, Mr. Clark thinks General Motors Diesels will get the nod.

"They're doing the job," he repeats, "and while we haven't had to demand any emergency service, we know we can get it plus parts no farther away than Houston. A farmer who depends on irrigation is depending on our pumps and engines."

Reservoir near Long Mott stores water for irrigation purposes.

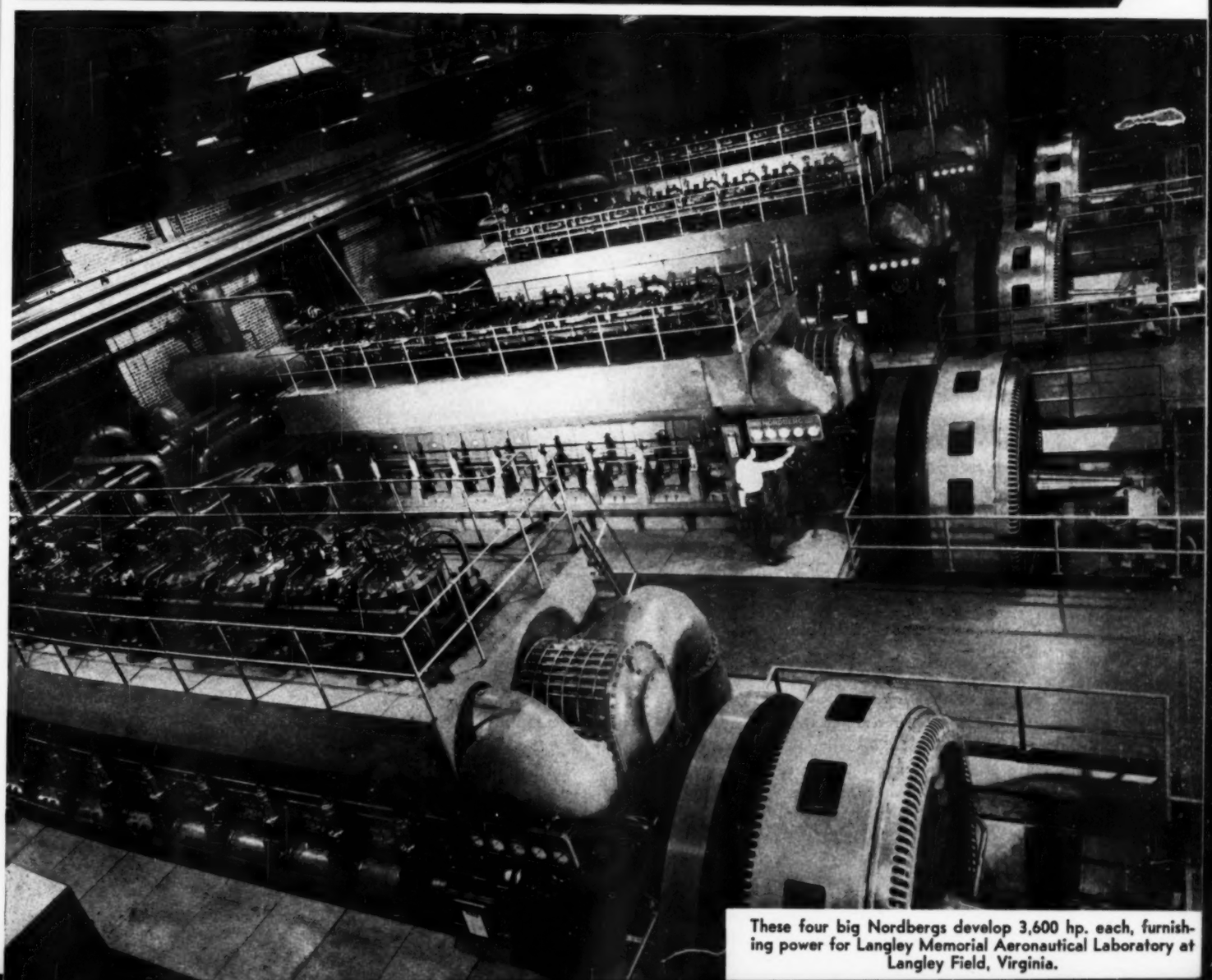




Power plant building at Langley Field built to house Nordberg Diesels.

Now it can be told...

DIESELS AT LANGLEY FIELD



These four big Nordbergs develop 3,600 hp. each, furnishing power for Langley Memorial Aeronautical Laboratory at Langley Field, Virginia.

IMPORTANT contributions to American air supremacy in the war were developed in the huge wind tunnels at research laboratories of the National Advisory Committee for Aeronautics, Langley Field, Virginia. Throughout the war period these tunnels and their giant fans were always ready for operation, with four Nordberg Diesel-driven generator sets supplying their demands—on little or no notice—for enormous and intermittent power peaks.

Justly proud of their wind-tunnel work during the war, N.A.C.A. officials are quick to point out that without the aid of their Nordberg Diesel-driven generator sets their program would have been seriously hampered. The four generators driven by Nordberg Diesel engines were installed in 1940 when the public utility system tied into Langley Field for handling normal loads could not furnish power for peaks required by the big wind tunnel fan motors.

Physically this station reflects its smooth and efficient performance. Situated in what is known locally as the West Area of the field, it is housed in a neat modern building erected for the purpose. The main entrance to the power house is on the north side of the building, and the visitor on entering is confronted by the four big Nordberg Diesels arranged parallel with each other. Along the back wall is the auxiliary pit containing heat exchangers, cooling water and fuel pumps, and fuel and lubricating oil strainers and filters. Immediately behind the building are cooling towers and exhaust stacks.

Although it is part of N.A.C.A. the research laboratory at Langley Field is known as the Langley Memorial Aeronautical Laboratory, or more briefly, as L.M.A.L. It was established in 1916 for the organized scientific study of aviation and flight problems. From the beginning of the war-emergency-period all its resources were devoted to the solution of immediate practical problems associated with the development and improvement of military aircraft. These activities were completely shrouded in the cloak of war time censorship. With the fog of war rolled away, however, it is now possible through the courtesy of N.A.C.A. officials both in Washington, D. C. and at Langley Field, to make public some of the features of this plant and its operation.

A glance at some of the larger wind-tunnel installations at L.M.A.L. will reveal something of the nature of the problems of operating this station. There is the sixteen-foot high-speed tunnel, requiring no less than 16,000 horsepower to drive its forty-five foot diameter fan. There are three other 8,000 horsepower tunnels, to mention but a few of the twenty-three tunnels of various sizes and functions at this field.

Owing to the dependability of the Diesel power plant it was possible during the war to operate these high-speed tunnels over long periods of time for the purpose of obtaining data on the improvement of war planes—both from the standpoint of pilot safety and combat effectiveness.

In these enormous tunnels with blasts of air roaring through them at incredible speeds, sometimes transonic in velocity, plane parts were tested under a wide variety of conditions. Plane models or full-scale components of planes were set up in the tunnels and blasts of air corresponding to air speeds of the planes in actual flight were blown over them. Elements of all types of war planes—fighters, bombers, reconnaissance planes, and many others—were examined and studied in this fashion.

These wind-tunnels were installed by forward looking N.A.C.A. officials who were fully cognizant of the implications of the national emergency period declared by the government in 1940. Prior to that time all current for operating L.M.A.L. had been purchased from a local public utility company. Installation of the huge wind-tunnel units, however, posed a power supply problem of serious proportions. These installations did not represent stable or static loading conditions. Any one, or a combination of several of them, might go into service for a few minutes or half an hour, with little or no warning to the power house. Obviously few public utility systems could economically supply transitory demands for peak loads under such conditions.

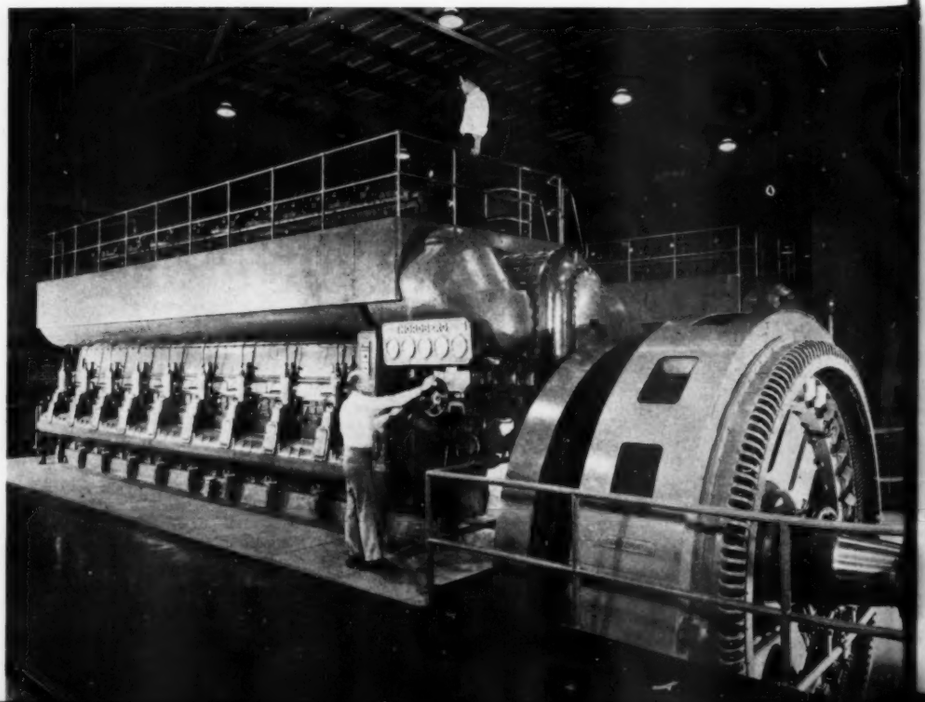
An appropriation was obtained and a central power station was built solely for the purpose of satisfying this transitory and intermittent demand for peak loads of thousands of kilowatts at any hour of the day or night.

Specifications for the plant were rather wide in their scope. Primarily it was required that the station should be able to carry peak loads at the field when wind-tunnels were in operation. In this connection, engine and generator sets were to be capable of starting and picking up loads within approximately fifteen minutes and to be suitable for frequent starting and stopping during any twenty-four hour period.

As the station was to be situated at a military aviation post it was desirable that it should be able to carry vital operating loads at the field in any emergency. Also, in the event of such an emergency, the station should be able to feed power back into the utility system. A natural corollary to these requirements was that engine-generator units had to parallel perfectly with each other, and that the station had to parallel, not only with the public utility system then tied into the field, but possibly with some different system in the future.

The engines and generators, therefore, were to be designed to provide for stable operation and good frequency regulation with rapidly fluctuating loads. In parallel operation they

Closeup of one of four 7-cylinder Nordbergs which drive 6,600 volt, 2500 kw alternating current Westinghouse generator supplying power for wind tunnel experiments.



were to introduce no objectionable surges or transient conditions in the line of the public utility system.

Unusually complete switchgear and supervisory equipment were specified and installed. The load dispatcher has before him at all times an indication of the load, current, reactive kva., and voltage of the utility system interconnection. He controls at all times the voltage and load on all generators. The load dispatcher, therefore, coordinates the use of power at all wind-tunnels and other equipment with respect to circuit and equipment capacity for carrying loads, and especially with respect to maximum demands created at any time on the public utility system.

Four Nordberg nine cylinder Diesels were finally selected as prime movers to handle the difficult job at this station. These engines are twenty-one inches bore by twenty-nine inches stroke, developing 3,600 horsepower at sea level, working at 225 rpm. They are of the well known Nordberg two-cycle, mechanical-injection, trunk piston type, with attached Roots-Connersville scavenging blowers.

The engines are directly connected to 6,600 volt, 2,500 kw. alternating current generators of the three phase, sixty-cycle, open, revolving field type. Each generator is provided with a high speed, belt-driven exciter of the rapid response type required for high-speed voltage regulators.

Early in the design stage of this plant, while engine types were still under consideration, doubts were expressed in some quarters as to the advisability of selecting two-cycle engines for this service operating at 225 rpm. It was believed that working the Nordberg engines at this speed would be questionable from the standpoint of power pulsations due to torque variations. These fears were allayed, however, by designing the engines with proper relationship between their rotational frequency and WR^2—another problem solved.

After seven years of operation, this station is a complete success and it has proved to be a great advantage to the local public utility system as well as to Langley Field. The utility system serving the field during the war was taxed to the limits of its capacity by virtue of other war-connected activities in the area. In view of this fact, L.M.A.L.'s contract for purchased power called for unusually close power factor regulation. It was possible, however, to utilize capacity of the generators at the station for correction of the power factor. This enabled L.M.A.L. to obtain considerably more power from the utility system than would have been the case had the station not been installed.

W. H. Payne, operating engineer of the L.M.A.L. power house, is proud of his engines and their record of dependability and almost instant readiness for operation during the war. In actual practice, he said, the fifteen minute warning for starts was in many instances entirely overlooked. It frequently happened that engines were put on the line under full load in less than five minutes—from a cold start.

He can also recall many eight-hour-shifts on which there were no fewer than twenty-six starts. These methods of operation were entirely a result of the necessity for utilization of all possible operating time of each wind-tunnel most efficiently.

Test set-ups in the wind-tunnels required long hours of preparation when no power was required. When the tests were ready to run, the load dispatcher at the power house was notified of the kind of test and the power required. If load conditions at the time of notification were such that engines were needed, they were immediately started—with no warning and little warming-up time.

An idea of operating conditions at this unique power plant may be gained from the following tabulation of running times and starts logged for the four Nordberg Diesels.

	Engine No. 1	*Engine No. 2*
Starts	5,656	8,080
Running Time	7,143H 55M	7,006H 37M
	Engine No. 3	*Engine No. 4*
Starts	6,195	5,065
Running Time	7,479H 57M	7,071H 08M

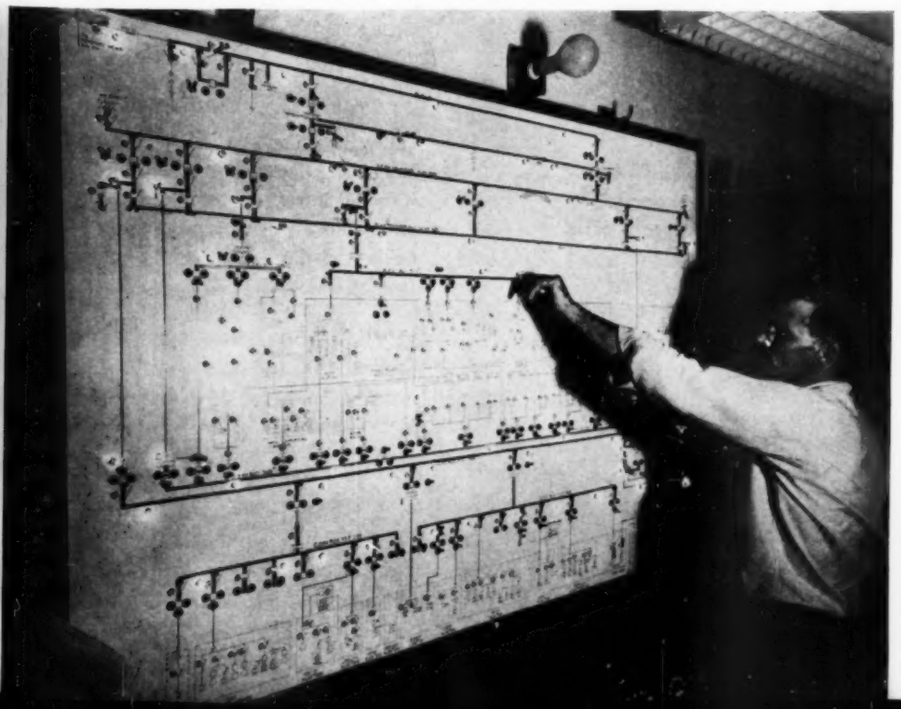
In spite of these unstable operating conditions, this Nordberg Diesel-driven power plant has shown over the past 5 years since it was placed in service a very good fuel economy, being averaged over the years better than 12½ kw. hrs. per gal.

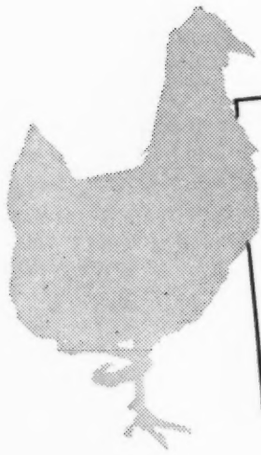
The fuel used is Standard Diesel Fuel No. 2 and 3. For engine bearings and rotating parts Texaco Navy Symbol 2190 lubricating oil is employed. Cylinders are lubricated by Texaco Navy Symbol No. 3080 lubricating oil. There are no centrifuges for either fuel or lubricating oil at this station, but both fuel and lube oil are strained and filtered. Honan Crane lube oil filters are in operation on the continuous system. Filter cartridges have an average operating life of 500 hours. Cartridges for both fuel and lubricating oil strainers last about 300 hours.

Operating procedure at the station requires that each engine be given a 500 hour crankcase inspection and a 1,000 hour bearing examination. Routine power cards are not taken, but a set of pull cards is taken from each engine once a week.

While the figures do not reveal a great output of electrical energy from the standpoint of kw. hours, it should be remembered that few power plants have a better record of effectiveness and useful achievement in war and peace.

Complicated power distribution board enables operators to control load factor of Diesel engines.

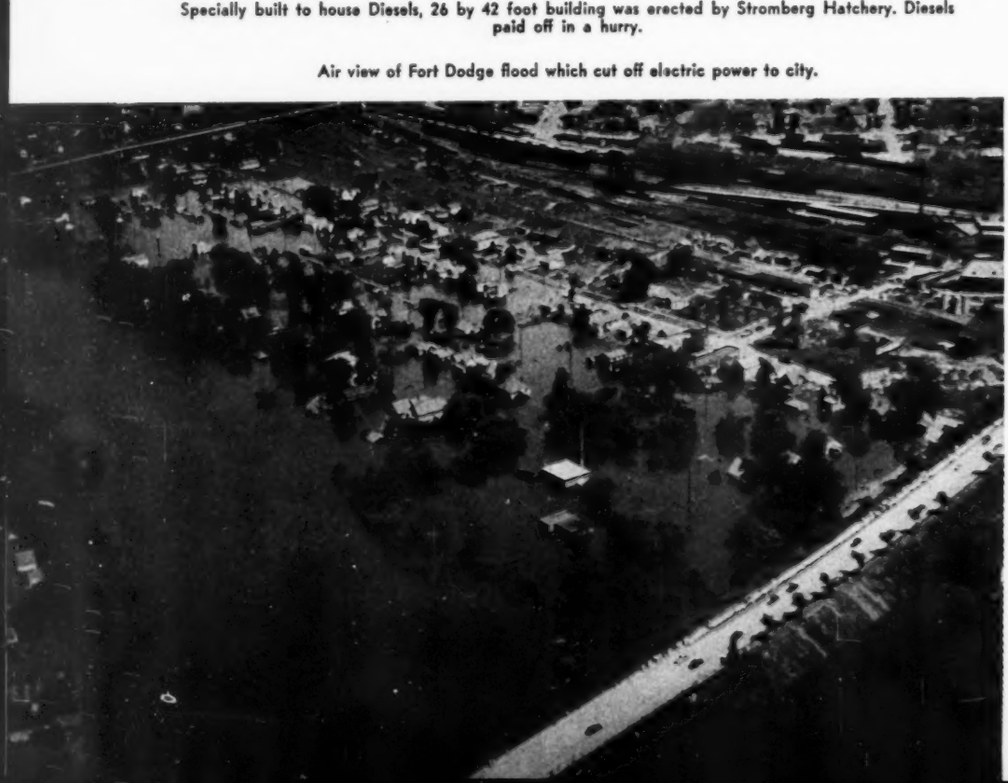




STAND-BY DIESELS SAVE HATCHERY $25,000

By JOHN F. MORTHLAND*

Specially built to house Diesels, 26 by 42 foot building was erected by Stromberg Hatchery. Diesels paid off in a hurry.



Air view of Fort Dodge flood which cut off electric power to city.

ON Monday morning, June 23, the six partners who operate Stromberg Hatchery, Fort Dodge, Ia., found themselves face to face with a grave emergency. Their incubators were loaded with eggs, their electric brooders were full of chicks, and their plant was without power! Just when they needed it most.

Their dilemma had been precipitated by a series of torrential rains, climaxed by a six-inch downpour the day before. When the electricity went off Monday morning, Loyl Stromberg, hatchery manager, had a hunch that something was wrong at the Fort Dodge municipal power plant, which is located beside the Des Moines river. Deciding to investigate, he drove down close to the river's edge. A single glance convinced him that the situation was really serious. Something had to be done.

"The streets were blocked off and the people were moving out of their homes," he reports.

Back at the hatchery, the fate of several thousand started chicks and over 300,000 eggs in the incubators, representing an investment of some $25,000, was at stake. Needless to say, the next several hours were busy ones for the Stromberg staff.

Last winter the firm purchased a Fairbanks-Morse Diesel powered electric plant for $20,000 with the intention of cutting power costs by using it as a private generating plant for the hatchery and as insurance against municipal power failure.

At the time the power failed, however, this plant was not ready for use. "The fact of the matter is," says Loyl, "neither of the two engines comprising the installation had ever been

* *Assistant Editor, "Poultry Supply Dealer"*

tested on our loads, nor were the power lines attached to the wiring system of the plant." Electricity was not available after 6:45 a.m. Monday. By 7:45 two electricians had been located and temporary wiring was hooked up. By 9:00 o'clock wheels began to turn and life preserving electric current was again doing its essential work. A tragic loss of $25,000 had been averted.

The newly installed Diesel plant had more than paid for itself in this one emergency. Without it, according to Mr. Stromberg, the eggs and chicks would have been a total loss except for their value as hog feed.

Part of the original delay in putting the generating unit into operating condition was caused by the necessity of rewiring a good share of the hatchery to handle the three phase current produced by both generators.

One is powered by a 120 horsepower, two-cylinder, Fairbanks-Morse full Diesel engine and has an output of 2,400 volts at 90 kva. capacity. The other is driven by a Fairbanks-Morse semi-Diesel and produces 2,400 volts with a 75 kva. capacity.

Either generator is capable of handling the total power requirements of the hatchery even when it is operating full blast, so when municipal power is dispensed with entirely, the installation will still represent a full time source of power as well as an auxiliary stand-by plant.

After almost learning their lesson the hard way, the hatchery's officials are unanimous in their efforts now to make absolutely certain they do not find themselves in difficulties again due to unexpected current breakdowns.

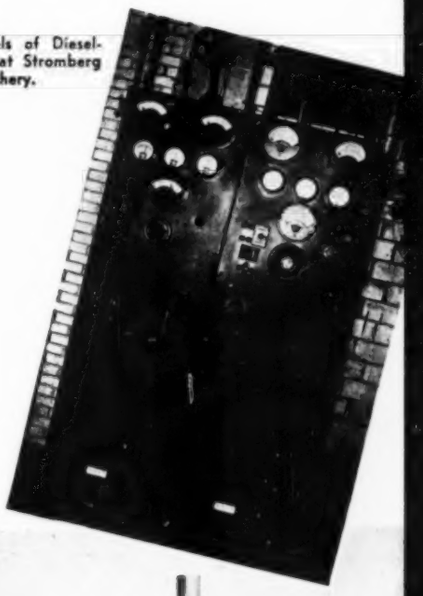
During the flood emergency the firm generously offered power to the Fort Dodge city fathers for use wherever it might be practical. It also made the hatchery offices available to commercial firms which were desperately in need of power.

On Tuesday night, for example, the Fort Dodge National Bank moved its billing machines to the hatchery and a number of its employees worked there the remainder of the week. Thus, the Diesels proved to be first class public relations emissaries, as well as efficient producers of electricity.

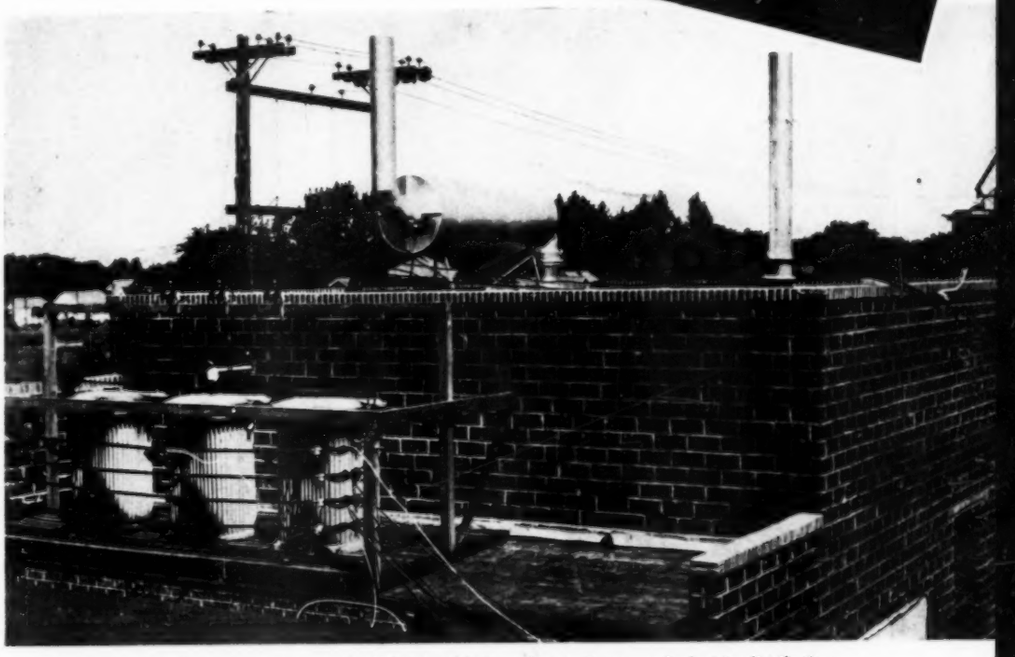
A special 26 by 42 foot building was constructed to house the power plant. It is built of hollow blocks and has a high ceiling with extra heavy "I" beams running the length of the building. These were installed so that an overhead hoist may be used in removing cylinder heads on either side of the two engines in the event of a breakdown requiring major repairs.

Stromberg Hatchery is located within the Fort Dodge city limits and consequently is surrounded by residences. In order to avoid ill feelings among the neighbors a Maxim silencer was placed on the larger 120 horsepower Diesel.

As a rule, cooling towers are the most popular means for maintaining proper operating temperatures of Diesel plants such as this one. However, the Strombergs chose a large radiator for cooling their engines.

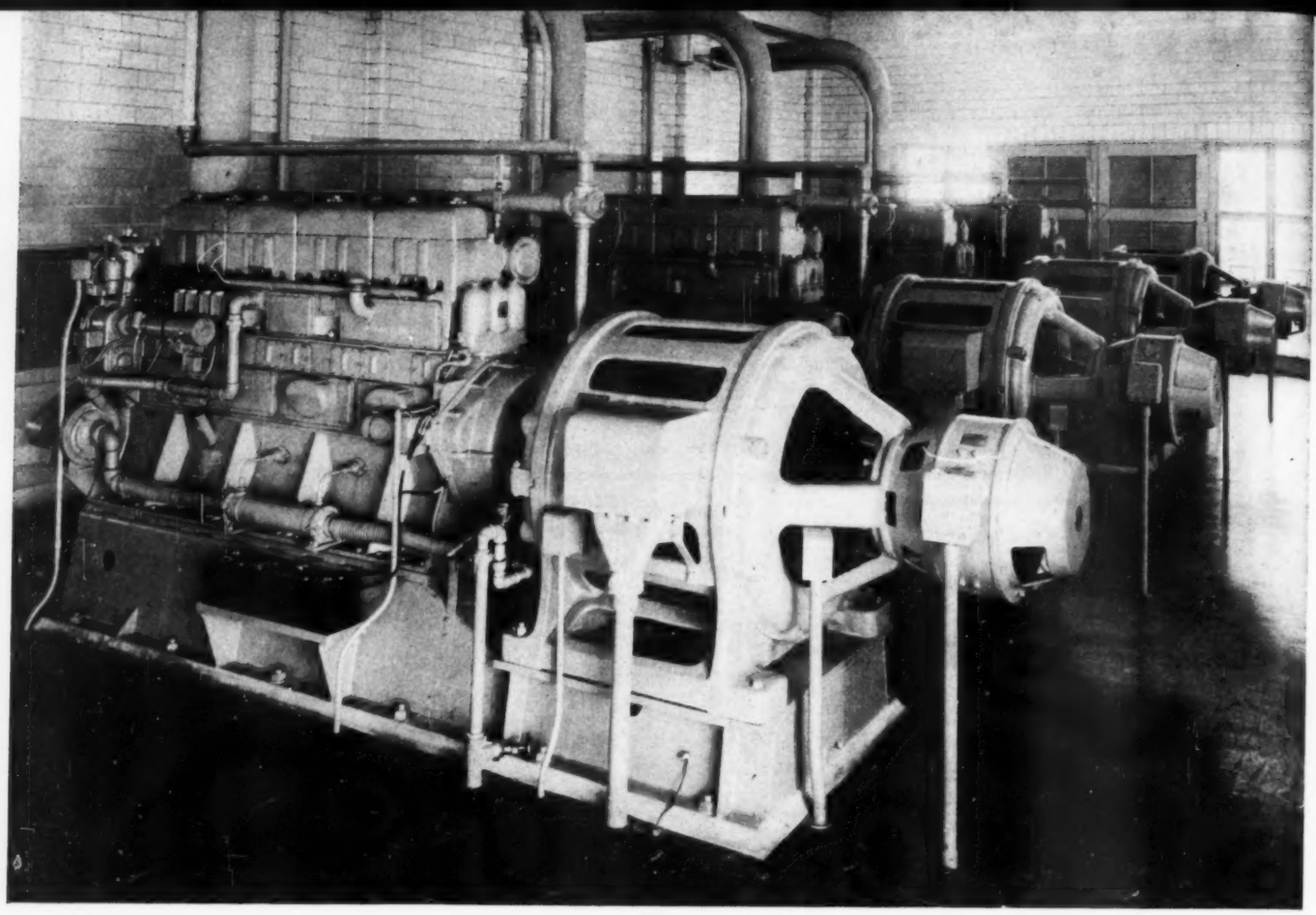


Control panels of Diesel-electric sets at Stromberg Hatchery.

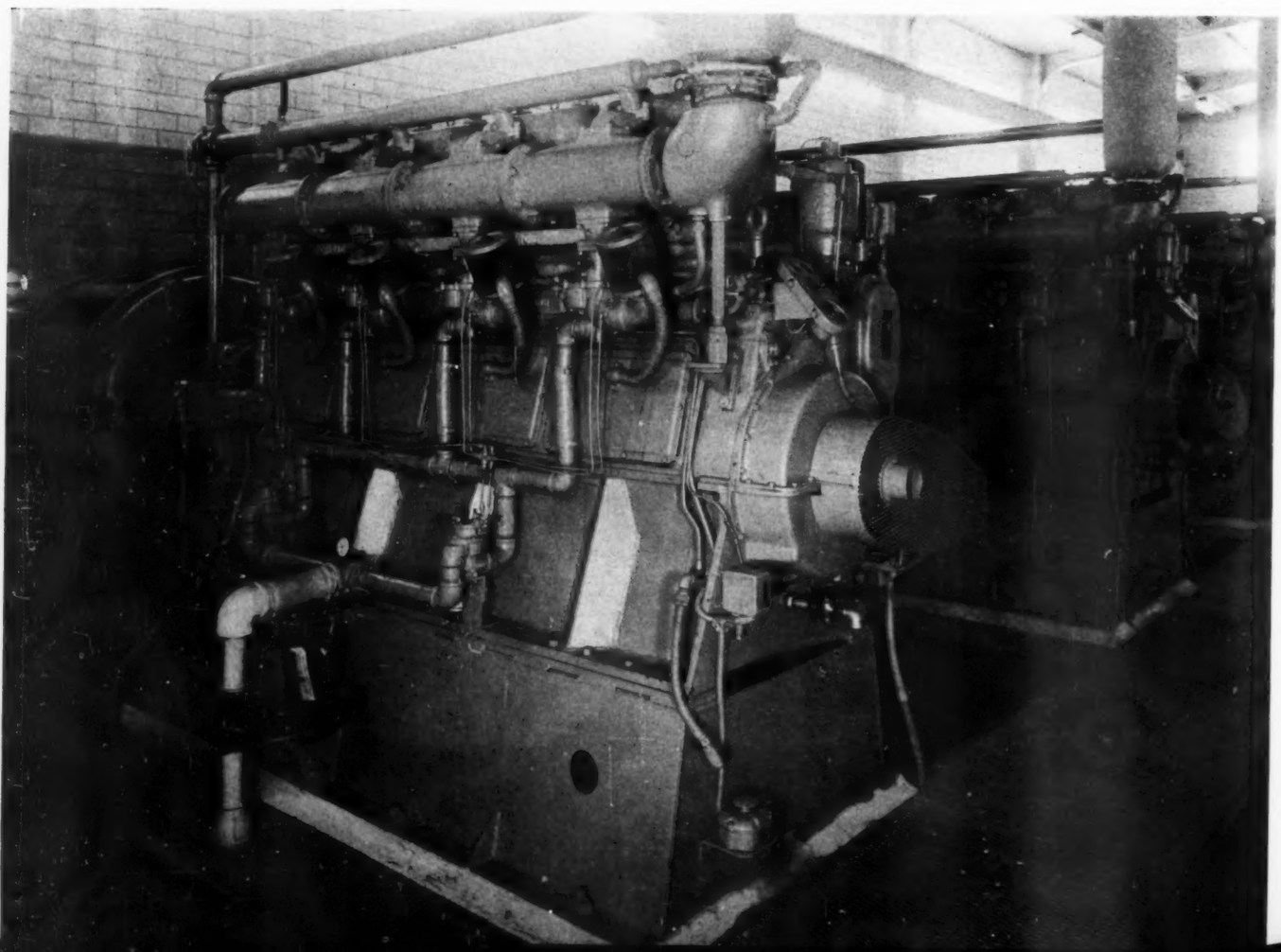


Rooftop view of Stromberg power plant showing Maxim exhaust silencer and electric distribution system.

Fairbanks-Morse Diesels installed at Stromberg Hatchery, one 120 hp, 2 cylinder engine driving a 90 kva generator and a semi-Diesel driving a 75 kva generator. Either engine can carry the full load demanded by the hatchery.



Engine room with four 600 hp Sterling Viking gas engines direct connected to Westinghouse generators. Note electrical starting, Gardner-Denver pumps for circulating cooling water. Cleanliness is a marked quality of this stand-by plant. Below. View showing intake sides of engines; note gas pressure regulator and mixing valves.



GAS ENGINES FOR EMERGENCY STANDBY

By DWIGHT ROBISON

WHEN you feel forced to buy something which you are quite positive you will never use very much or very often, and which in fact you profoundly hope you will never need at all—and in fact may not, there is a readily understandable thought that here is where you had better shop around, paying as little as possible for what may never be used.

However. Perhaps the item in question is one which, if ever needed, must function without question. It's something like buying life insurance, in such a case; you can always find a cheap policy, but maybe the firm will go broke by the time somebody who needs the money can cash the policy. So, economy must add up to the paying of as little as possible commensurate with the desired security.

Houston, Texas, was in this sort of situation. Houston is a big city and far from bankrupt, yet the management does not believe in throwing money away. In Houston they found the road to economy.

For proper understanding of the state of mind of L. R. Bagwell, electrical engineer for the city of Houston, one must go far from Texas and consider the customary path of the West Indies hurricane. These glorified twisters generally make up to the southeast of the Indies, move northwest, cross the lower part of Florida and then either swing back into the North Atlantic or move into the Gulf of Mexico. If they take the latter course, they head northwest for a space, then either swing inland generally east of Mobile or else continue northwest, passing the mouth of the Mississippi and going inland in west Louisiana or east Texas, say around Galveston. They generally plaster this section plentifully and Houston is the next station.

So reasoned Mr. Bagwell. Now the city had a new water plant, in the southwest of town, built just a few years ago and serving a rapidly growing section where many fine homes are being built, and where the famous Rice Institute is located. The location of the plant is between the suburbs of Bellaire and Alief.

Between the pumping plant and Alief, on the Alief Road, are seven deep wells in a stretch of about six or seven miles. These wells are of considerable capacity; each can deliver around 3,000 gallons per minute. However, they are not flowing wells but have to be pumped.

Handling each well is a big pump driven by an electric motor of 300 hp, which is all well and good when no hurricane is in the vicinity blowing down power transmission lines. True, from the plant to each well the cable is underground and theoretically free from damage, but there are still the lines to the plant to consider. And as people always need water, in time of storm or disaster as well as in good weather, the city's engineer was determined to have a set of stand-by pumping units.

As the units might never see real service, a low investment seemed to be called for. As a stand-by is in fact no stand-by at all unless it is dependable, high quality was also a requisite.

So Mr. Bagwell investigated natural gas engines. This fuel is cheap in Texas, where the land is literally sitting on an inexhaustible puddle of oil and gas; in fact, gas fuel is considerably cheaper even than Diesel fuel.

The abundance of gas deciding the fuel, it was noted that the lower pressures of gas-burning engines as compared with Diesels could lead to engines of less costly construction. The situation called for four engines of 600 hp each, to be sure of ample power in case of emergency, and four 600 hp Diesels would run into money. Gas engines should be cheaper, but the engineer was determined to have high quality as well as favorable price.

This quest took him to Buffalo, New York, to the plant that makes the Sterling engines. He saw the engine made, saw them running, and then just to be thoroughly sure he also visited the Westinghouse plant and checked up on the generator situation. The result of Mr. Bagwell's investigations was the purchase of four Sterling Viking gas engines, equipped with Westinghouse generators.

The engines are the model TC-8, of eight cylinders, 8" bore by 9" stroke, delivering 600 hp at 1200 rpm, burning natural gas for fuel.

Normal pressure on the gas line to the plant is around 100 lbs; to reduce the pressure to the engines, a pressure regulator is installed dropping the pressure to 8 ounces per square inch.

From the pressure regulator the gas is piped to two mixing valves where air is taken in and mixed, and from there goes to the Ensign carbureters serving two cylinders each.

For ignition, the same system is used as for gasoline combustion, that is, distributors and spark plugs; four spark plugs are used for each cylinder.

The generators direct connected to the engines are the Westinghouse 2-bearing type with 7½ kw direct connected exciters. Turning at 1200 rpm, the generators are of 400 kw, 2400 volts.

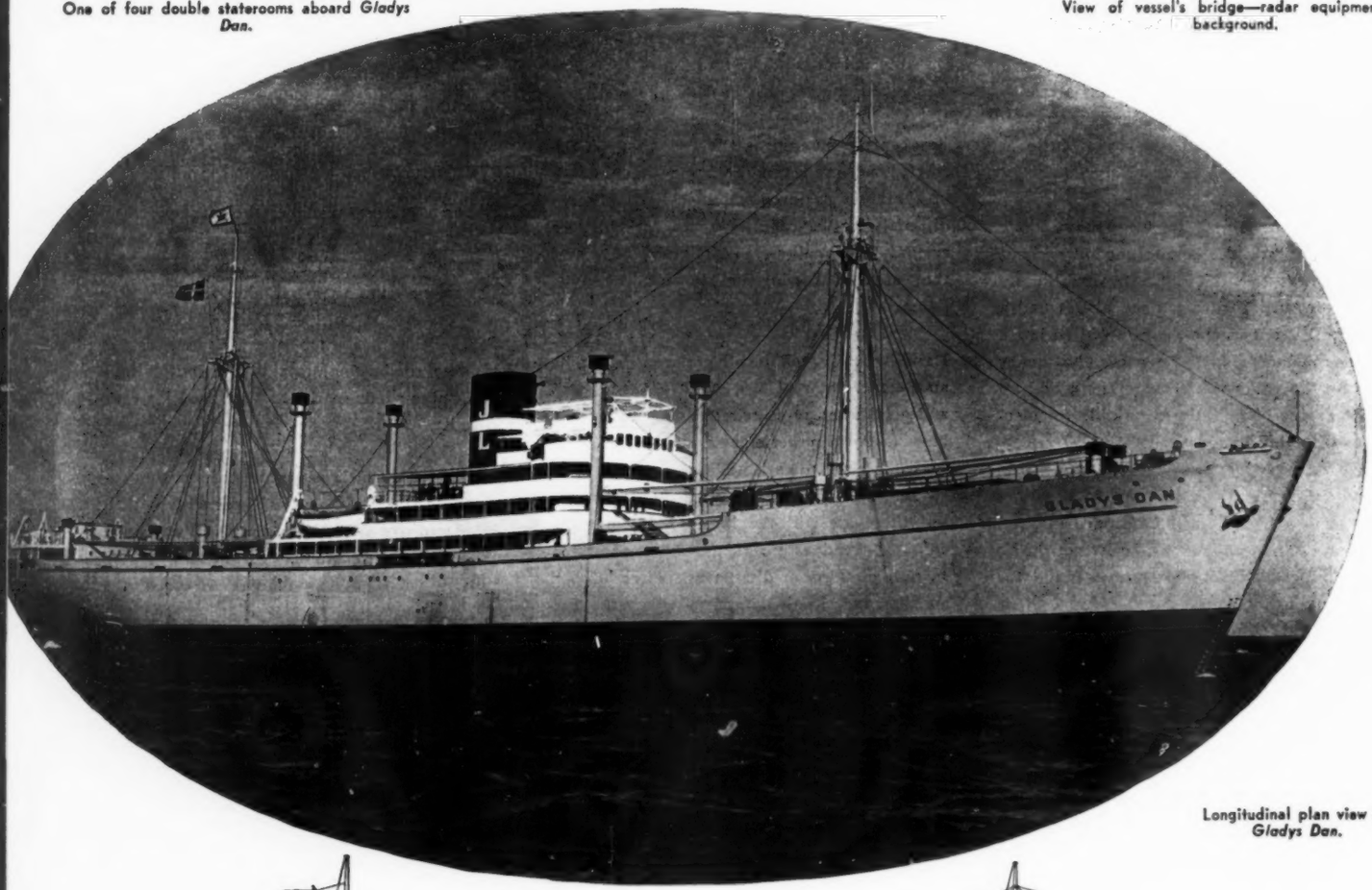
Installation work was handled by the city's crew; the city also furnished its own switchboard. The Sterlings and generators were purchased through the Houston Engine & Pump Co., H. H. Gilvray, manager.

The Sterlings are equipped with electric starters and respond promptly. Once a week the outfits are started and run for a while, just to be sure. No real storm or emergency has so far occurred to demand steady operation of these splendid machines; however, this is a stormy area, definitely in the hurricane track, and these stand-by generating sets could be of immense value to the community. Every city, in fact, would do well to equip itself with such stand-by power for its water service, before some disaster puts emphasis on the need.

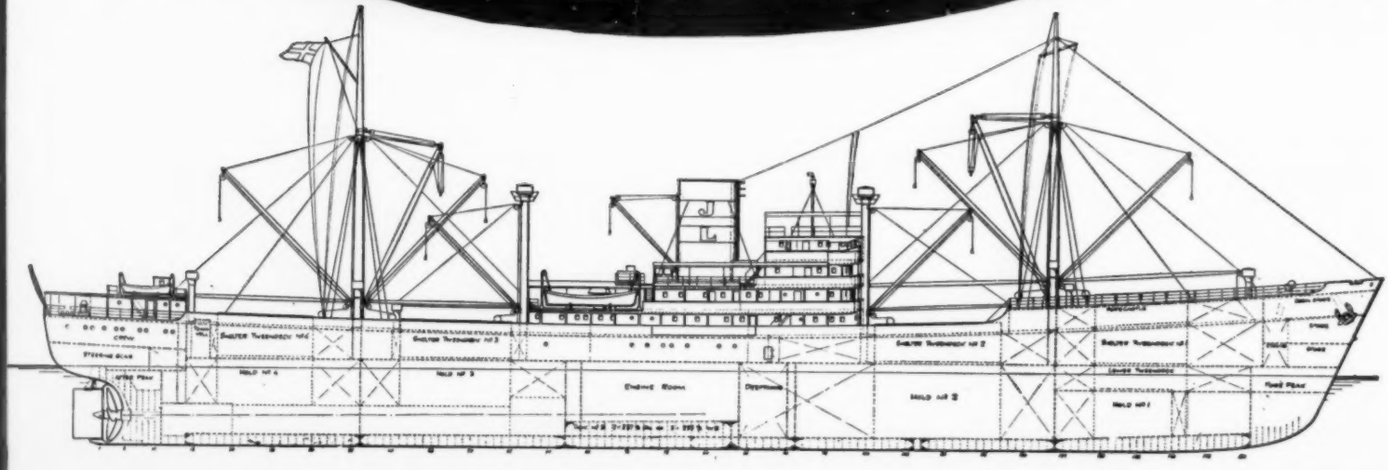
So Houston's electrical engineer got what he wanted—low cost dependability.

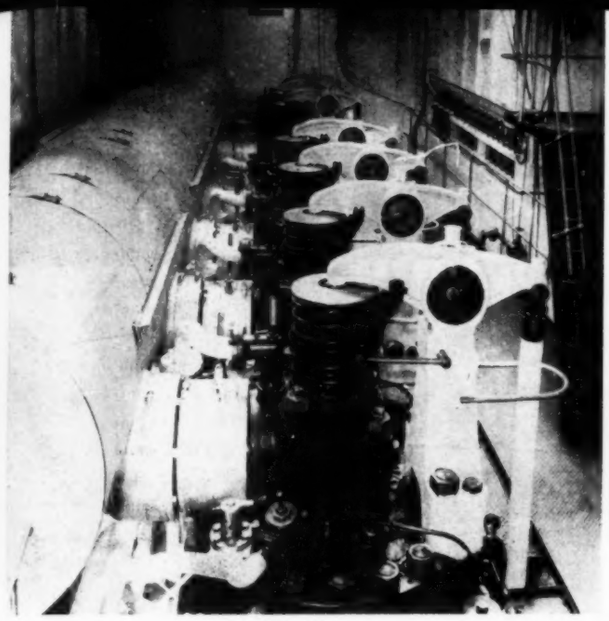
One of four double staterooms aboard *Gladys Dan.*

View of vessel's bridge—radar equipment in background.

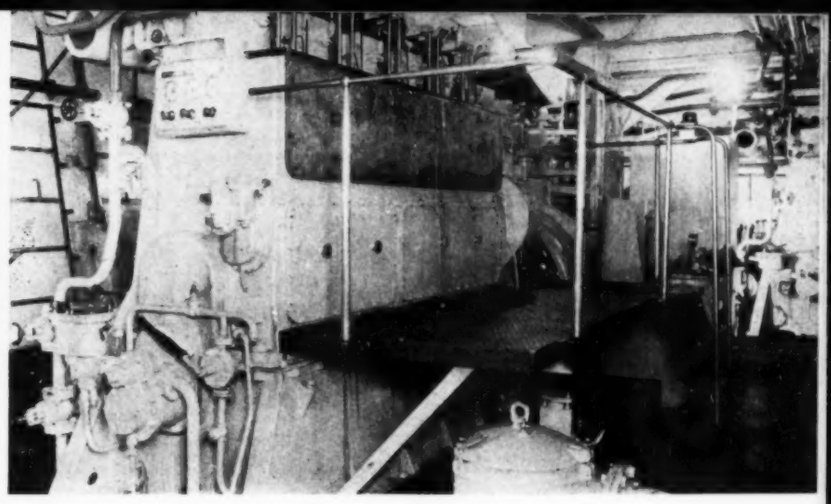


Longitudinal plan view of *Gladys Dan.*



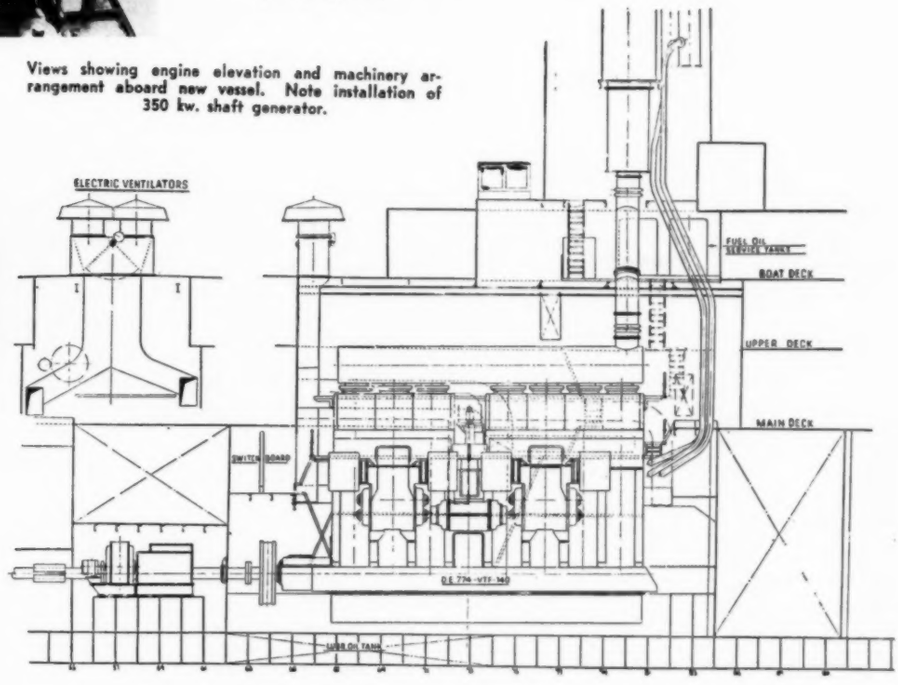


Top of 5650 bhp. Burmeister and Wain Diesel which supplies propulsion.



One of two 280 bhp. B & W auxiliary Diesels aboard vessel.

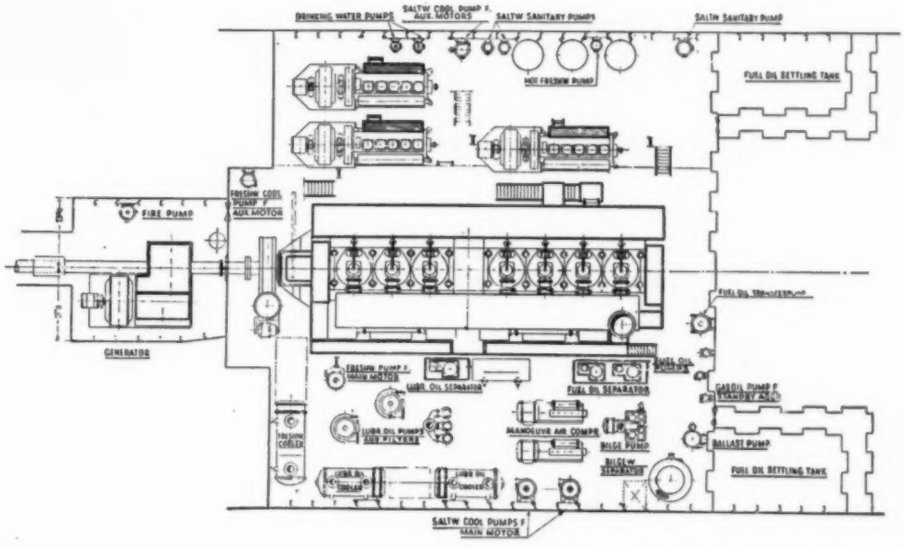
Views showing engine elevation and machinery arrangement aboard new vessel. Note installation of 350 kw. shaft generator.



The GLADYS DAN

EARLY last fall the Diesel ship *Gladys Dan* was delivered to her new owners, J. Lauritzen one of Denmark's leading shipping lines. The new vessel was built by Burmeister and Wain, who also supplied the main and auxiliary Diesels. The *Gladys Dan* was built as an open shelter deck vessel 432.7 feet overall with a beam of 54.7 feet and a draft of 25 feet. Her deadweight tonnage in long tons is 6475. She is a combination passenger and freight vessel with a 397,000 cubic foot capacity in four holds and passenger accommodations for eight persons in four cabins.

For main propulsion the *Gladys Dan* is equipped with a Burmeister and Wain direct reversible, single acting, two-stroke, 7-cylinder crosshead Diesel. The bore is 29.1 inches while the stroke is 55.1. The normal output of this engine is 7000 ihp. or 5650 bhp. at 120 rpm. Her trial trip showed a bmep. of 89 at 125 rpm. while the engine was developing 6700 bhp. Three single-acting, four-stroke, 5-cylinder trunk piston engines supply auxiliary power needs and drive 3 AC generators. They have a bore of 9.6 inches and a stroke of 15.7 and develop 280 bhp. at 500 rpm.



Los Angeles County Diesel Smoke Control Program

with some pertinent advice from Pacific Freight Lines' Gus Martin, on how to prevent exhaust smoke

By FRED M. BURT

EXCERPTS from "Interim Report on Smog Situation," submitted by Raymond V. Darby, Chairman Los Angeles County Board of Supervisors, tell us that:

"In 1306 the smog problem was so bad in London that an artificer was executed for burning coal in violation of the Royal edict. Los Angeles County has attacked its smog problem less dramatically, but more effectively. No one has been executed or put out of business. Only five criminal complaints have been filed under the County Air Pollution Control Ordinance. But substantial progress has been made towards cleaning up the atmosphere.

This ordinance eliminated the necessity of proving a common law nuisance as to visible smoke. A simple chart was substituted for the cumbersome common law test. Thus, with legal authority and a good chance of securing a conviction, an Air Pollution Inspector can make polite and friendly suggestions. He can secure immediate, voluntary compliance with the law. All of the inspectors employed by the County are experts, engineers, chemists or chemical engineers. They can analyze almost any unit and tell why it smokes. They use the educational or engineering approach.

The County Air Pollution Office has been successful in securing cooperation from all sources. On its Diesel Hearing Board, representatives of the truck owners and of the drivers' union sit side by side. They have agreed to the jurisdiction."

While Los Angeles City has set up its own Air Pollution Control enforcement, State legislation now in effect (almost unanimously passed), provides for the creation of county-wide districts, to give the control officers jurisdiction within the cities.

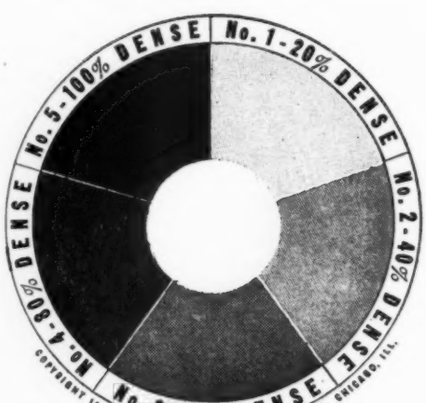
The representative membership of the Diesel Smoke Abatement Hearing Board of the County of Los Angeles, consists of A. ("Gus") Martin, Maintenance Supt. of Pacific Freight Lines; W. G. Stewart, Shop Supt., Asbury Transportation Co.; Tony Lombardi, Road Supt. Cantlay & Tanzola; Wade Sherrard, Gen. Mgr., the Motor Truck Association of Southern California; and W. F. Dykes, N. Evankoff, and H. L. Woxberg from Local 224, Line Drivers' Union, Teamsters' Union.

Chairman of the Board is Ed Stampfli, Enforcement Officer, a Civil Service appointment under authority of the County Board of Supervisors. He is assisted by H. R. Crabaugh.

These Diesel experts patrol pre-arranged territories, in County cars, four days a week (in the office on Fridays), using the chart to make observations of Diesel smoke densities, of dozens of units each day. These are recorded on a Daily Report.

Smoke of Number one density, (20%) or Number two, (40%), are passed as 1) Excellent, 2) Acceptable, but if greater densities are observed, the operator of the truck, or other Diesel unit, is given the first, white, copy of a Citation; the second, blue carbon copy kept for office record. On the back of the Citation, is the questionnaire which must be filled out satisfactorily, and returned within nine days (although three days is printed on the form), and returned to the Office of Air Pollution Control. If the returned questionnaire shows that the proper steps have been taken to correct the smoke condition, the case is dismissed. If not, or if subsequent inspection shows that they were just kidding in the answer, or if the citation is not answered, the violator is ordered to appear before the Board at its next meeting.

RINGELMANN TYPE SMOKE CHART



AVOID SMOKE OF NUMBER TWO OR GREATER DENSITY!

Office of Air Pollution Control
County of Los Angeles

see reverse side for instructions

APC 32 SM 8-47

There has been excellent compliance, as up to the last meeting (before this writing), but five violators have not complied. They found that the Board meant business. Fines for each individual and first offense, may range from $5 to $500 for various violations.

APCD 104 6-47

OFFICE OF AIR POLLUTION CONTROL
COUNTY OF LOS ANGELES
808 N. Spring St.
Los Angeles 12, California

CITATION

Date ..... 194..

Name .....

Vehicle Lic. No. ..... Cab No. .....

Address .....

Violation On .....

From ..... To .....

Wind: N E S W Weather: Clear Cloudy Fog Rain Hazy

SMOKE							VEHICLE											
DRAW	STOPPED	No. Min.	DENSITY 2 3 4 5				GRADE Level	Up	Down	APPROX. SPEED 25	35	45	55	Direction N E S W			Loaded	Empty	Freight

SMOKE FOR ..... MIN. Remarks: .....

YOU ARE CHARGED WITH VIOLATION OF THE LOS ANGELES COUNTY AIR POLUTION CONTROL ORDINANCE.

You are directed to appear at .....

..... on ..... at .....

You are directed to completely fill out and mail questionnaire on opposite side within 72 hours to DIESEL SMOKE ABATEMENT HEARING BOARD, OFFICE OF AIR POLLUTION CONTROL, County of Los Angeles, 808 N. Spring St., Los Angeles 12.

FAILURE TO COMPLY WILL RESULT IN FURTHER ACTION AS PRESCRIBED BY LAW.

No 2311 By .....

Gus Martin as Maintenance Superintendent for Pacific Freight Lines, operating in Arizona and California, has the heavy responsibility of keeping nearly 1100 transportation units in prime operating condition. This fleet includes 30 tanker trucks, five freight trucks, and a large number of 22 ft. Fruehauf trailers with converter gears; with the principal motive power a mixed fleet of 249 two-axle truck-tractors, with Cummins Diesel engines; Sterlings, Kenworths, Autocars, and new, "West Coast," heavy duty Internationals.

To get right down to cases on Diesel maintenance and operation, the following valuable and pertinent data, relating largely to Diesel smoke control and its basic causes, plus methods of correction, is taken from a very complete and well illustrated book written and compiled by Mr. Martin, for use by other Diesel maintenance men and operators. (Title—"On the Highways with the Cummins Diesel"—acknowledgments to the engineers of Pacific Freight Lines for road study data, G. W. Wallace, Consulting Engineer on fuels and lubricants, Dr. Francis Christensen, University of Southern California, and to Cummins Engine Company for permission to use illustrations.)

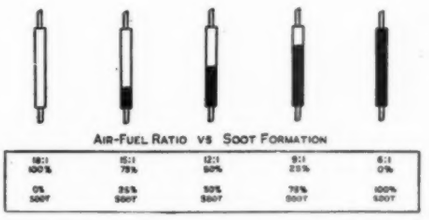
Starting off with primer facts, and sticking to them, the book describes combustion in a Diesel engine simply and descriptively.

It emphasizes the fact that in high-speed Diesels the problem of mixing fuel and air is complicated by the short time interval available on the power stroke. At 1800 rpm. the time is only six-thousandths of a second.

Under ideal conditions, a combination of 18 parts air and one part of Diesel fuel is required for complete combustion, an air-fuel ratio of 18:1. But as a working engine does not provide perfect conditions, a higher fuel ratio is required in most cases.

Testing an engine on a dynamometer under load conditions, with a fuel analyzer, when a smokeless exhaust on the test engine shows that combustion is complete, a reading of 11% CO_2 on the analyzer shows that the air-fuel ratio is 24:1. At 15% CO_2 which represents the theoretically adequate ratio of 18:1, a smoky exhaust shows that more fuel is being injected into the cylinder than there is air to burn it.

When the fuel-pump setting is advanced to compensate for loss of power, it just aggravates the problem of too much fuel and too little air. The fuel-pump setting recommended by the engine designer is intended to supply the cylinder with all the fuel it can burn at full throttle under full load, and with an ample supply of excess air. On the dynamometer, the air-fuel ratio as shown by the analyzer, should vary from about 100:1 at idling speed, to about 24:1 under full load.

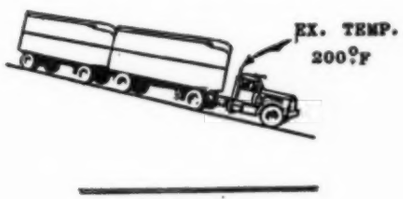


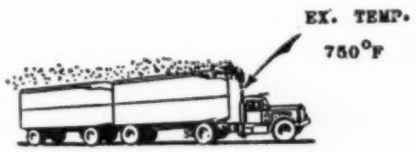
On the highway, engine power output varies with the temperature. Cold air is denser than hot air so cold air in the cylinder weighs more than warmer air and allows the burning of more fuel with more heat and power. With every variation of 10° below or above 90°, the horsepower of any Diesel engine rises or falls about 1%. If the temperature should pop up to 120°, as in desert driving, the rpm. must be raised, in order to use the air-spaces in the cylinders more often to get more air weight for complete combustion of the amount of fuel required for full engine power output.

Smoking is especially bad when the engine is "lugging," which occurs when the throttle is held open while the engine is turning well below the governor setting. The remedy for consequent smoking is to shift to a gear low enough to bring up the engine speed.

If an engine is in good adjustment and properly handled, low exhaust temperatures are a sign of low compression, faulty timing, clogged spray nozzles, or low water jacket temperatures —all of which mean that the engine is burning its fuel imperfectly.

On the other hand, excessive temperatures in an engine are a sign of after-burning. Part of the fuel is not burned in the cylinder where its heat can be converted into power, but burns wastefully in the exhaust system. After-burning is the result of over-fueling, or of late timing, or of using a fuel that ignites too slowly.





Most of this boils down to a single principle: to get power the driver must maintain the engine's speed, and for this he is provided with a large array of gear ratios. On the other hand an engine designed to operate up to a given speed must not be operated in excess of that speed, which is the reason that all Diesels are equipped with governors to hold them below that excess speed. Some drivers defeat this purpose by allowing the truck to push the engine beyond this limit while going down hill in gear. This spreads the weights of the gov-

. . . . *And now please turn to page 79* . . . .

At the speakers' table, left to right: William E. Corrigan, Vice President, American Locomotive Company; J. H. G. McConechy, Chief Engineer, Sun Shipbuilding and [illegible] Motor Ship; E. J. Schwanhausser, Vice President, Worthington Pump and Machinery Corporation, and President, Diesel Engine Manufacturers Association, [illegible] Robinson, U.S.N. Rtd., Administrator, Webb Institute of Naval Architecture; George W. Codrington, Vice President, General Motors Corporation, and General Manag[illegible] Robert E. Friend, President, Nordberg Manufacturing Company; O. O. Lewis, Assistant General Sales Manager, Diesel Division, Fairbanks, Morse & Co.; Gordon Lefebv[illegible] pany; A. P. [illegible] of the Panel Diesel Engine Cooper-Bessem[illegible]

D.E.M.A. SPONSORS MARINE DIE[illegible] P

Discussion Featured A. P. Chalkley, Editor, The Bri[illegible]Motor

OVER two hundred interested marine men attended a panel on "The Use of Diesel Engines in Ocean-Going Vessels" conducted under the auspices of the Diesel Engine Manufacturers Association at the American Merchant Marine Conference in New York, October 16, 1947. Discussion was led by four outstanding authorities, in their respective fields. The question and answer period was lively and constructive.

Papers were delivered by: Robert E. Friend, President, Nordberg Manufacturing Company; J. H. G. McConechy, Chief Engineer, Sun Shipbuilding and Dry Dock Company; Admiral S. M. Robinson, U.S.N., Rtd.; and A. P. Chalkley, Editor, The British Motor Ship. Mr. Chalkley delivered a masterful report on "European Motor Ship Development," emphasizing the preponderance of Diesel propulsion machinery in foreign shipping and shipbuilding. Mr. Chalkley took the brunt of a lively discussion from the floor—answering a barrage of questions with clear, concise and informative statements. Because of its wealth of information and impact on marine machinery planning, Mr. Chalkley's paper will be published in two parts in early issues of DIESEL PROGRESS.

Mr. Friend spoke on "Diesel Engines in Cargo Vessels During the War." He showed that in the period from 1939 to 1945 Diesel ship construction in U. S. for Maritime Commission and private interests totaled 2,158,623 dead weight tonnage and 1,073,290 hp. These figures included only ships of 3000 or better D.W.T., and do not include a number of Naval vessels amounting to some 375,152 D.W.T. and 280,000 hp. which were fitted with Diesel propulsion. Mr. Friend pointed out, with regret, that many of our Diesel ships have been sold into foreign registry. "One objection to the motorship under the American flag stems from the fact that operating crews demand higher pay on motorships than they do on steamers," he said. "There is today absolutely no justification for any differential," Mr. Friend added.

"What then is the solution? Let me suggest that the American way of life affords for our boys an opportunity to forge ahead, and rather than pay our Diesel engine room crew more money in basic wages than we pay a steam crew we should afford them an opportunity for earning an over-all incentive based on the total savings of the Diesel engine propulsion of a ship over a specified period of time as compared to a fixed figure for steam propulsion," said Mr. Friend.

Mr. Friend concluded, "Negotiations have recently been opened by prominent marine Diesel engine builders in three European countrie[illegible]

for the c[illegible] marine pr[illegible] American [illegible] show, if an[illegible] can Marin[illegible] of age an[illegible] equality w[illegible] builders."

Mr. McCo[illegible] can Shipy[illegible] he spoke [illegible] He said, "[illegible] concerned, [illegible] propelling [illegible] should be [illegible] Because w[illegible] purchased [illegible] function o[illegible]

Comparing[illegible]

...ilding and ...pany; A. P. Chalkley, Editor, The British ...ssociation, ... of the Panel; Admiral Samuel Murray ...neral Manag... Diesel Engine Division, General Motors; ...ordon Lefebv... Cooper-Bessemer Corporation

...DIESEL PANEL

...Bri...Motor Ship

for the construction, under license, of large marine propulsion engines of the design of one American manufacturer. This merely goes to show, if any proof were needed, that the American Marine Diesel Engine industry has come of age and that it stands on a basis of full equality with the best of the European engine builders."

Mr. McConechy developed the theme, "American Shipyards Can Build Diesel Vessels," and he spoke from a wealth of actual experience. He said, "As far as the American shipyards are concerned, the problem of obtaining suitable propelling machinery, whether the choice should be Turbine or Diesel drive, is identical. Because with very few exceptions the units are purchased outside of the shipyard and the main function of the shipyard is to install the unit."

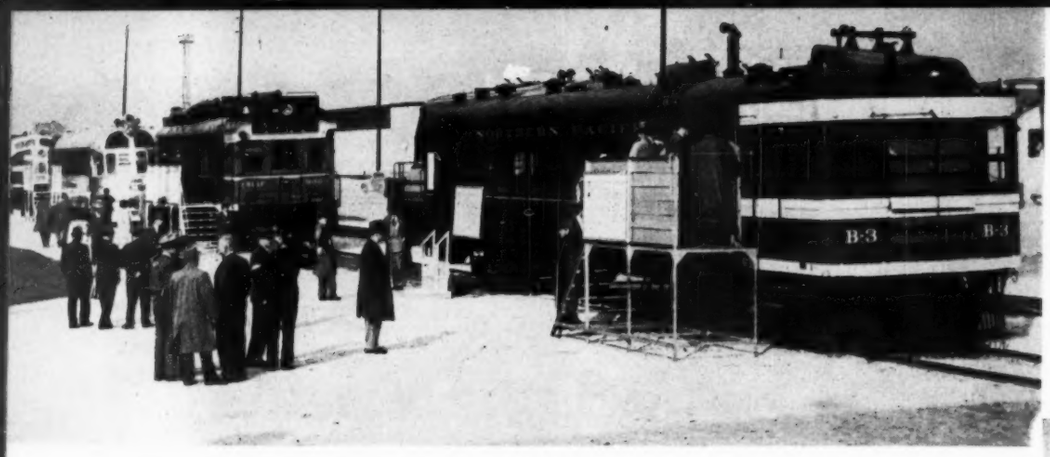
Comparing similar type vessels, Mr. McConechy showed that the cost of either direct Diesel drive or geared Diesel drive is practically identical with that of cross compound turbine with double reduction gears and high pressure boilers or turbo-electric drives. He pointed out that, given the same routine maintenance, the repairs to a Diesel plant should not exceed the repairs necessary for a turbine installation.

Admiral Robinson gave his "Observations Concerning the Development of the Diesel Engine in the Marine Field." He said, "As early as 1926 and '27 the Navy Department, in its desire to extend the use of Diesel machinery, made every effort to get built an experimental engine of light weight and high speed, but . . . it was not until 1932 that the Navy Department was able to get this work started; at that time five companies signed contracts for the development of a light weight, high-speed type of engine. Out of this beginning, a highly successful engine was developed for submarines and its use spread to many other purposes in the commercial field ashore as well as afloat; in particular it was taken over enthusiastically by our railroads. As we all know, nothing succeeds like success and one after another, most of the Diesel manufacturers have brought out engines of this type with the result that the Navy Department and the Merchant Marine have been able to spread their uses of Diesel engines to an almost unbelievable degree."

Admiral Robinson added, "That all this development work was undertaken was indeed a fortunate thing for this country, and, I may add, it was done in the nick of time—just barely. In fact some of these experimental engines were still unfinished when World War II broke upon us but most of them were ready for use and if we had not been ready, I do not know how we could have fought World War II. In any case, I am sure the war would still be going on if it had not been for the Diesel industry. . ."

Quoting a recent conservation with a former Chief of the Bureau of Ships, Admiral Robinson said that the Navy Department built over 100,000 ships during the war and that 90,000 of these were propelled by Diesel engines, and the other 10,000 ships were filled with Diesel-driven auxiliaries. Admiral Robinson paid high tribute to our American Diesel Industry, saying, "We undoubtedly have the finest Diesel industry in the world—one of which every American citizen can be proud and no segment of American industry did a better job during the war than did the Diesel industry. While comparisons are always invidious, I think we might almost say that no other industry had quite the staggering responsibility placed on it than did this industry so far as the maritime field was concerned."

All in all this Panel was a constructive move on the part of D.E.M.A. The attendance and reception of it by marine engineers and ship operators indicated intense interest. Diesel-mindedness in the marine field was greatly stimulated.



Two of Electro-Motive's first products take place of honor in exhibition area. Northern Pacific and Rock Island Railcars are honored along with Burlington Zephyr and Train of Tomorrow, Electro-Motive's latest development.

H. L. Hamilton, founder of Electro-Motive, (right) accepts congratulations of Charles F. Kettering, former head of General Motors research on 25th anniversary of company.

ELECTRO-MOTIVE CELEBRATES 25th ANNIVERSARY

THE story of the spectacular rise of the Diesel locomotive to its present high position of preference on American railroads from its humble beginnings in the first successful gasoline-electric rail car in the early twenties was told recently in a program which featured the Twenty-fifth Anniversary Celebration of Electro-Motive Division of General Motors at LaGrange, Illinois.

Business and civic leaders of the Chicago area and top railroad officials from throughout the country joined with high officials of General Motors and the twelve thousand Electro-Motive employees in paying tribute to H. L. Hamilton, who founded the organization. From a one-room office in Cleveland, Ohio in 1922, Electro-Motive has grown to two plants in the Chicago area totalling 2,500,000 square feet of space in 1947, Mr. Osborn disclosed. More than 4,500,000 horsepower has gone into railroad service in General Motors Diesel locomotives made by Electro-Motive since the LaGrange plant opened in 1935. The current production rate will increase this more than 1,500,000 horsepower a year. The plant now is producing four mainline locomotive units and one switching locomotive per working day.

The celebration brought together the chief figures in the early days of the now well established movement toward Dieselization of American railroads. Reminiscing with Mr. Hamilton were Charles F. Kettering, a Director of General Motors and its retired research chief; Ralph Budd, President of the Burlington Lines; Fred Gurley, President of the Santa Fe Railway; Charles E. Wilson, President of General Motors; R. K. Evans, Vice President of General Motors; and John L. Pratt, retired Vice President and now a Director of General Motors.

Mr. Osborn paid tribute to all of these men as having made important contributions to either the engineering development of the Diesel locomotive, its application on the railroads, or the specialized mass production technique worked out by Electro-Motive.

But most of the praise was reserved for the founder, Mr. Hamilton, now also a Vice President of General Motors.

"It does not happen very often in the history of human endeavor," said Mr. Osborn, "that people are privileged to participate in the creation of a new idea, in the pioneering of its acceptance and in the sharing of that greatest of human satsifactions, the building of a great new industry."

As a lasting tribute to the man who finally put the internal combustion engine to working successfully on standard gauge railroads, a life size bas-relief of Mr. Hamilton was unveiled. This bas relief was made by Paul Manship of New York City, one of America's greatest living sculptors. It will be a permanent tribute.

The new Locomotive Development Center is a two story building. In it will be concentrated all of the personnel and facilities for future development work on General Motors locomotives, whether the power be Diesel or ultimately some other prime mover. Beyond the customary facilities for engineers and draftsmen found in a manufacturing plant, the Center will have the finest specialized equipment for research, testing and experimental manufacture. The building includes a bay in which an entire experimental locomotive can be put together, tested, or torn down.

An exhibit of old and new rail cars, locomotives and the General Motors Train of Tomorrow was located on tracks adjacent to the Development Center. One was the oldest EM rail car in service, which happens to be the second car put out by the company. It is a 175 horsepower combination baggage, mail and passenger car built for the Northern Pacific Railroad in 1924. This car still is in operation out of Brainerd, Minnesota. With the rail cars were famous Diesel locomotives. One is Unit No. 9907A of the Burlington which went out o fthe Electro-Motive plant in the fall of 1936. It has travelled 3,695,942 miles, all of which have been on the Denver Zephyr. Also exhibited is the Santa Fe Railway's GM Diesel freight locomotive No. 100. This was the first Diesel freight locomotive ever to go into regular revenue freight service. It left the Electro-Motive plant in December, 1940.

UNION PACIFIC ORDERS ANOTHER 300,000 HP OF DIESEL LOCOMOTIVES

By CHARLES F. A. MANN

Chairman E. R. Harriman Calls For "Second Rebuilding of Union Pacific System", With Appropriations for Additional $89,000,000

In the Pacific Northwest, Oct. 27, 1947 . . . It was revealed exclusively to DIESEL PROGRESS today by Messrs. Harriman, Ashby & Charske, top Union Pacific Officers that an additional $89,000,000 was voted at a Directors' Meeting in Boise, Idaho, a few days previously. Out of this $89,000,000 about $29,000,000 is set aside to purchase an additional 83 Diesel locomotives totalling 300,000 horsepower, to further push back steam power on this giant western system.

FOLLOWING by scarcely 6 weeks the official announcement of purchase of a group of Diesel locomotives totalling 281,000 horsepower, largest order ever placed for motive power in history, the additional 300,000 hp. order takes on the proportions of something sensational. November DIESEL PROGRESS was off the press before word was released by Mr. Harriman, Chairman, and Mr. Ashby President, while on tour of the U.P.'s vast Northwest network. Characteristic of Mr. Harriman's late father, E. H. Harriman, he took practically his whole Board of Directors; the top operating and traffic officers and the Omaha Administrative Staff from headquarters, on a 10 car special train, with Business Car No. 100 and a Conference-Observation car, bearing the flag for the trip, over nearly ¾ of the U.P. mainline mileage. This Executive Special was proudly drawn on its month-long Western tour by a brand new 2-unit Fairbanks Morse Diesel locomotive, equipped with plenty of boiler and water and fuel capacity and bearing every last-minute safety and operating device the FM boys could load aboard before train time.

Previously the first 281,000 hp. Diesel order group was released in connection with the budgeting of $100,000,000 for major reconstruction of the System on a grand scale.

At a banquet given on the trip for a Civic group, Chairman Harriman drew a parallel to the 1947-1948 Rebuilding Program to that undertaken by his father, back in 1910. Being the first Western Transcontinental, by 1910 the light rail, bridges and heavy grades and curves were inadequate for 20th Century equipment, so the Civil War-conceived Union Pacific had to be completely rebuilt.

Now, the age of Air and Highway, plus pressing economic factors, make it necessary to again rebuild and revamp the far flung system in step with our high speed era. The two big groups of orders, plus those already at work on the System, will make Union Pacific a neck and neck competitor of Santa Fe in the way of Diesel, with nearly 750,000 Diesel horsepower at work! The balance of the additional $89,000,000 voted by the Directors in Boise, will go for more miles of heavy rail; electronic signalling, curve and grade reduction and rolling stock on a grand scale.

Perhaps the most sensational phase in this bold, dramatic way the Union Pacific has of doing things, is in a little-publicized, almost unknown phase of the business, having to do with a big answer as to "What About the Old Steamers?"

On a scale almost as grand as the buying of new Diesel locomotives, Union Pacific is disposing of its mighty roster of Steam power—and at an even faster pace.

President Ashby announced in Los Angeles November 10 that 331 Steam locomotives on the Union Pacific would be retired and either disposed of or scrapped to feed the West's scrap-short budding steel industry at Geneva and Fontana. 331 locomotives is almost 19% of the total inventory of U.P. steam power. And to be scrapped in ONE YEAR!

Contrasted with 67 steamers retired in 1946, this clinches the argument that Union Pacific is "Going Diesel" as fast as any railroad on earth. No timid storing of dead steam power and piling more Diesels into and on top of the motive power inventory.

This should be the answer to the tongue-in-cheek fears of some U. S. railroads who gingerly acquire Diesels and quietly coat their old steamers with lead paste and park them out behind the roundhouse—"Just in Case"—which may allay nervous fears over Union Labor discrimination against Diesel, the price of oil or the cheapness of coal or the big two Electric Company's screaming about electrification.

The scrapping of 42,650 tons of steam power on the Union Pacific develops three interesting but simple economic facts.

1. Steam switchers are the deadest dead ducks in all our U. S. transportation mechanism, including the railroads. They die with the old steam farm tractor and belt-driven thrasher.

2. Slow Mallets—simple and compound, are likewise dead ducks. Either your heavy power will run at least 65 mph. or it must be scrapped.

3. Lightweight 1910 brands of steam locomotives bow out now. This should wake up the Commuter Railroads with phobias against scrapping their light steam, fearing new light Diesels will cost too much and hence the Commuter Runs will go bankrupt.

Locomotive addicts throughout the USA know and revere the Mikado or MacArthur freight locomotive as one of the best designs ever originated in the USA. But, Union Pacific is scrapping 82 MacArthur- (Mikados before Japan insulted us!) steamers. So farewell to another chapter in the life of the Iron Horse. It now looks like goodbye to Old Trusty that ran on more railroads, more daily ton miles than any other steamer ever devised in the world's history.

As we go to press, telegraphic advice from Omaha indicates the status of the 300,000 new batch of orders is as follows:

32—6000 hp. Diesel freight locomotives.
6—6000 hp. Diesel passenger locomotives.
15—1500 hp. Road-freight locomotives
25—1000 hp. switchers
5—2000 hp. transfer Diesels

As of Nov. 12, the orders so far placed in this fresh new group of 82 Diesels breaks down as follows:

10—6000 hp. freight—EMD Div. of General Motors
20—1000 hp. switchers—EMD Div. of GM
10—6000 hp. freight—American Locomotive Co.
15—1500 hp. road switch—American Locomotive Co.
1—2000 hp. heavy duty—Fairbanks Morse
5—1000 hp. switchers—Baldwin Locomotive Works, Eddystone, Pa.

DIESELS IN UNDERGROUND MINING

Part II

By D. HARRINGTON *and* J. H. EAST, JR.

Editor's Note: We present the second part of **Diesels In Underground Mining** *by D. Harrington and J. H. East, Jr., Chief of the Health and Safety Branch, Bureau of Mines and Senior Mining Engineer, respectively. The authors point out the advantages of Diesel over both electric and gasoline powered equipment from the standpoint of safety and economy. The discussion also includes some excellent advice on the subject of proper ventilation of Dieselized Mines.*

A LIMESTONE mine, which is opened by two shafts about 2,200 feet deep, is using six Diesel-engined trucks, each having a capacity of 6 cubic yards, for haulage units and a Diesel bulldozer for clean-up purposes. A two-entry room-and-pillar method of mining is used to extract a 17 foot bed of limestone, which is approximately horizontal. The entries are driven 16 feet wide and 17 feet high; the rooms are advanced about 30 feet wide for a distance of 600 feet. On retreat, approximately 12 feet of additional top rock is mined, making the final room size about 30 feet wide and 29 feet high. Ventilation is induced by a reversible fan operating blowing; about 66,000 cubic feet of air per minute is circulated through the mine in two splits. The haulageways are ventilated by return air when possible.

The trucks are powered by 2-cycle, 4-cylinder Diesel engines with a 4¼-inch bore and 5-inch stroke. The engines develop 107 hp. at 1,800 rpm. The trucks are fitted with a threespeed transmission and a reverse gear, which gives the trucks three speeds in either direction. The bulldozer develops a drawbar horsepower of 60.1 with a governed speed of 1,500 rpm. A Diesel tractor equipped to load material is an auxiliary rock-loading unit; a 1½-ton truck fitted with a 4-cycle, 4-cylinder engine is used as a service truck.

The large trucks are loaded by an electric shovel or by the Diesel tractor and transport the limestone to the hoisting shaft; a round trip requires 7 to 10 minutes, and each truck makes 30 to 40 round trips a shift. The engines of the trucks are stopped while the trucks are being loaded. Analyses of the samples of the general mine air taken in two working faces and in the main return at the shaft bottom where three Diesel trucks had passed in the preceding 7 minutes are shown in Table C. Some analyses of the exhaust gas taken from the large Diesel trucks while idling and while under varying loads are noted in the Table D. The successful use of Diesel equipment at this mine is significant. The mine shaft is about 2,200 feet deep, and ventilation of the working places is induced by mechanical means. The volume of fresh air taken into the mine is sufficient to dilute and carry away the toxic gases of the exhaust from the Diesel engines, and the analyses of the samples of the general mine air indicate that the air in this mine is better than ordinarily found in mines, notwithstanding the use of seven different units of Diesel-powered equipment within the mine.

TABLE C

Sample location	Face of room A	Face of room B	Main return at shaft bottom
Oxygen	20.92	20.72	20.92
Nitrogen	79.02	79.08	79.02
Carbon dioxide	.06	.16	.05
Carbon monoxide	.00	.00	.00
Methane	.00	.04	.03
Total	100.00	100.00	100.00

TABLE D

	Truck idling		Truck working	
	Truck 2	Truck 5	Truck 2	Truck 5
Oxygen	19.67	19.85	16.87	11.55
Nitrogen	79.41	79.29	80.17	81.67
Carbon dioxide	0.89	0.80	2.93	6.68
Carbon monoxide	0.03	0.04	0.03	0.07
Methane	0.00	0.02	0.00	0.03
Total	100.00	100.00	100.00	100.00
Oxides of nitrogen, parts per million	64	13	175	46
Aldehydes, parts per million	30	40	?	?

Diesel tractor loading gypsum underground

An underground limestone and shale mine in one of the Central States is using internal-combustion engines as power units for most of the operations other than loading rock. The use of Diesel engined, portable air compressors and drill jumbos mounted on Diesel Caterpillar tractors is not common practice. Three trucks used for haulage purposes are equipped with gasoline engines, and a fourth truck is Diesel. Approximately 800 tons of rock are produced daily at this mine.

Mechanical methods of ventilation are not provided, but two concrete-lined shafts supplement natural ventilation; one shaft is 14 feet in diameter, and the other is 7 feet. Considerable air movement in the mine workings is induced by the piston effect of the large trucks moving in the relatively narrow passageways. The air measurements taken indicate that approximately 20,000 cubic feet of air per minute is circulating through the working sections of the mine. Portable air compressors of 350 and 500 cfm. capacity and powered by Diesel engines are used. Drill jumbos mounted on Diesel-driven Caterpillar tractors are moved from one working place to another as required; in moving, the Diesel tractor pulls the portable air compressor to the new working place.

Electric-powered shovels load the broken rock into 10-wheel Diesel trucks.

The general mine air along the haulageways

and in the vicinity of the working places was sampled, using vacuum tubes and a supersensitive carbon monoxide indicator. The carbon monoxide concentration was too low to be detected by the indicator, which indicates accurately 0.001 per cent carbon monoxide.

The use of gasoline engines underground is considered hazardous by the Bureau of Mines; the exhaust from a gasoline engine contains much more carbon monoxide than that from a Diesel engine under normal working conditions; in addition, the fire and explosion hazards of gasoline are much greater than when the less flammable Diesel fuel oil is used.

There are two principal methods of determining the amount of ventilating air required to operate a Diesel engine safely underground; both of these methods are shown in Bureau of Mines publications and are discussed below.

Diesel engines, when in good mechanical condition and operating in normal air, give off noxious gases in the exhaust; and the quantities increase in amount with the brake horsepower of the engine. At full speed and maximum load, the tests made by the Bureau of Mines and others show that the following amounts of noxious gases are produced per brake horsepower by a Diesel engine:

	c.f.m.
Carbon dioxide	0.267
Carbon monoxide	0.000592
Oxides of nitrogen	0.001512

On this basis it has been determined that approximately 75 cubic feet of air per minute per brake horsepower is required for each Diesel engine operating underground; this is the minimum requirement and is in addition to the normal ventilation supplied the working place if Diesel engines are not employed; additional volumes of air are also required to dilute the aldehydes as well as undesirable even though harmless odors.

Another method of determining air requirements is calculating the volume of the noxious gases evolved by the engine and the maximum amount of these gases considered tolerable for a working environment has been established. The quantity of air that should be supplied to dilute a particular constituent of the exhaust gas can be approximated by substituting in the following empirical formula:

$$Q = \frac{100\ Vmax}{y}$$

in which Q = volume of normal air required for ventilation, cubic feet per minute.

Vmax = maximum volume of the particular constituent under consideration, cubic feet per minute.

y = maximum permissible concentration of the particular constituent under consideration, expressed in percent by volume.

The exhaust of a Diesel egine is a mixed gas; the constituents considered harmful to health are carbon dioxide, carbon monoxide, and oxides of nitrogen. Hence, the total ventilating air requirements must be sufficient to dilute and carry away all of these. To satisfy this condition the formula becomes

$$\text{Minimum quantity of ventilating air, cu. ft. per minute} = \frac{100\ Vmax}{y}\ (\text{Carbon dioxide}) + \frac{100\ Vmax}{y}\ (\text{Carbon monoxide}) + \frac{100\ Vmax}{y}\ (\text{Oxides of nitrogen})$$

In addition to the minimum as obtained from the formula, enough air must be supplied to dilute the odors of the aldehydes and to main-

Caterpillar Diesels in Missouri limestone mine

tain the required amount of oxygen in the general mine atmosphere.

For instance, a 6-cylinder Diesel engine has a piston displacement of 425.3 cubic inches and developed 165 hp. at 2,000 rpm. The exhaust-gas analysis when the engine was operating at maximum load and full speed was:

	Percent
Oxygen	13.04
Carbon dioxide	5.88
Carbon monoxide	.09
Methane	.03
Nitrogen	80.96
Total	100.00
Oxides of nitrogen, parts per million	295

$$\text{Volume of exhaust gas c.f.m.} = \frac{425.3 \times 2{,}000}{1{,}728} = 493 \text{ cubic feet}$$

Method No. 1

Maximum prake horsepower, 165 bhp.
75 cubic feet of ventilating air per minute per brake horsepower.

Minimum ventilating air required = 165 × 75 = 12,375 cubic feet per minute.

Method No. 2

Volume of gas produced per minute:

Carbon dioxide, cu. ft.	493 x 0.0588	= 29
Carbon monoxide, cu. ft.	493 x 0.0009	= 0.44
Oxides of nitrogen, cu. ft.	493 x 0.000295	= 0.145

The maximum permissible concentration of noxious gas in a working environment, as shown in Schedule 22 issued by the Bureau of Mines, is:

	Percent	Parts per million
Carbon dioxide	1.0	10,000
Carbon monoxide	.01	100
Oxides of nitrogen	.0025	25

Substituting in the formula for minimum quantity of ventilating air:

$$\text{Min. quant'y vent. air cfm.} = \frac{\text{Carbon dioxide } 100 \times 29}{1.0} + \frac{\text{Carbon monoxide } 100 \times 0.44}{0.01} + \frac{\text{Oxides of Nitrogen } 100 \times 0.145}{.0025}$$

$$= 2900 + 4400 + 5800$$

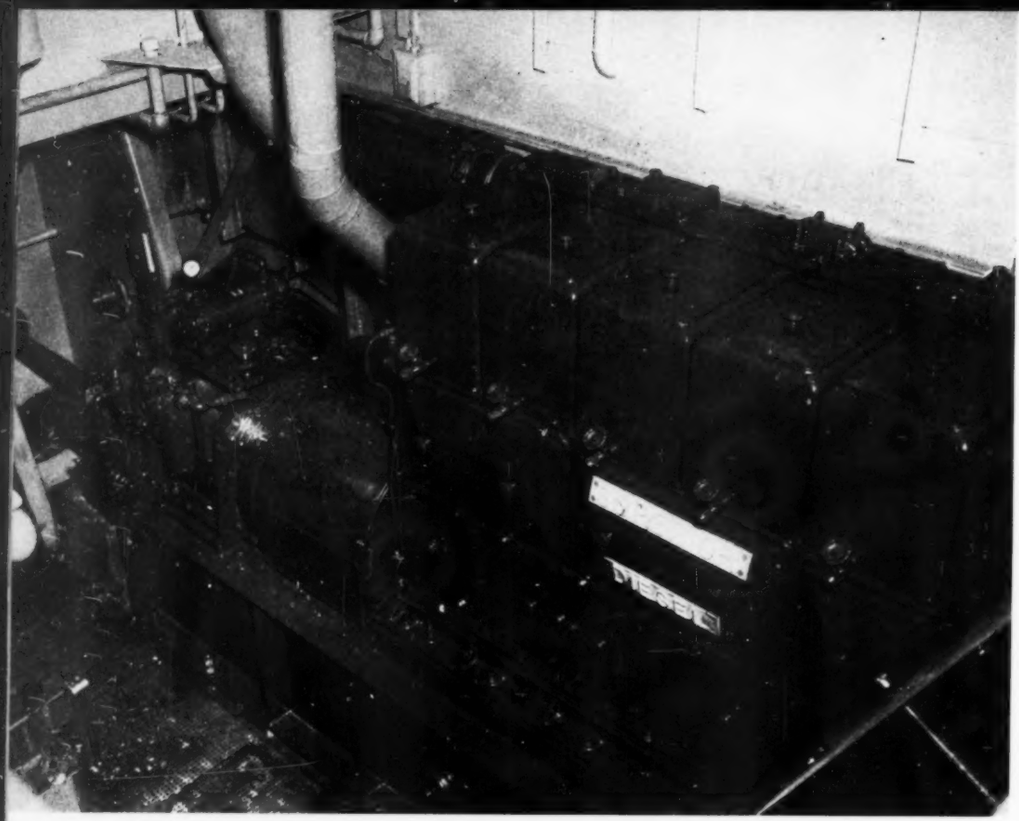
$$= 13{,}100$$

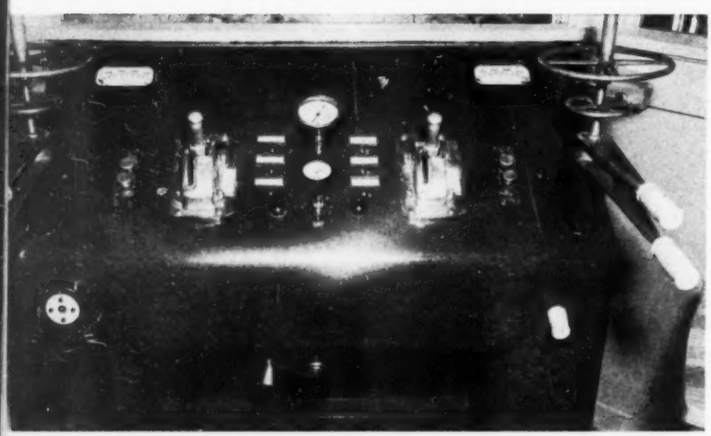
Evidently both methods give approximately the same results as to the necessary amount of air needed to prevent the exhaust gases from being either toxic or of nuisance proportions.

The mining laws and regulations of some States prohibit the use of internal-combustion engines in underground mines: the laws and regulations of other States permit their use provided permission is obtained from the Department of Mines prior to their installation. Such laws are intended primarily to prevent the use of gasoline-powered mine locomotives and other equipment. They were placed in effect before the Diesel engine was developed to its present stage of safety and efficiency and it now appears that they should be modified to allow use of Diesel equipment under certain prescribed conditions.

The trolley wires are a prolific cause of mine fires and explosions in coal mines. Between 1930 and 1944, 30 mine fires and 50 explosions are known to have resulted from this cause, and 355 workers lost their lives owing to these occurrences. Fires and explosions from this cause may be largely if not wholly eliminated by using Diesel locomotives, since European statistics indicate that no mine fires or explosions have been caused by Diesels in coal mines.

Diesel locomotives designed for use underground are no longer in an experimental stage . . . . *And now please turn to page 89* . . . .

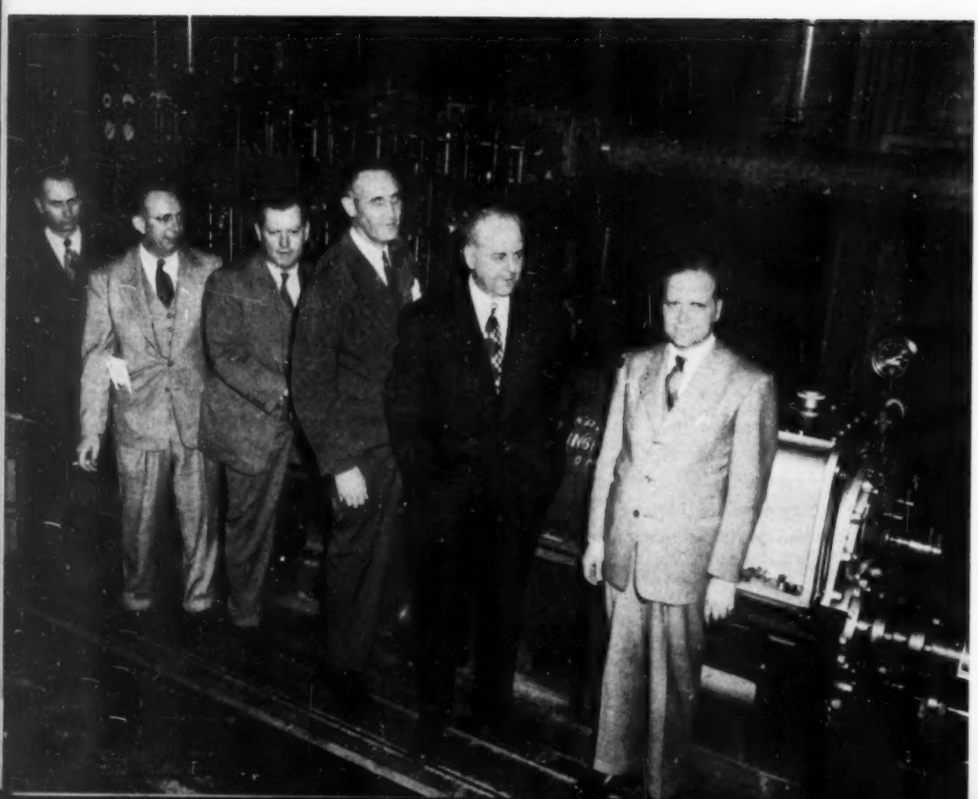




One of two 270 hp, 750 rpm. Superior Diesels aboard "W. F. McCrady"

Control stand furnished by Westinghouse Airbrake Co. provides separate control for each main engine.

(Below) During Engine test, observers included, (left to right), J. W. Tuttle, Westinghouse Air Brake; K. W. Morrisey, of Falk Corp.; W. Rodgers, McCrady-Rodgers Co.; R. Baggaley Jr., McCrady Rodgers; L. R. Herbert, Falk Corp.; and E. L. Davis, Falk Corp.



McCRADY-RODGERS Company wanted a lot of push in a small package and they got it in the form of the *W. F. McCrady*, a new Diesel towboat. The company needed a towboat that was small and yet powerful enough to handle heavy sand and gravel barges with authority. Moreover they had to combine compact construction with maneuverability and the capacity for storing a 20-day fuel supply and 10-day water supply aboard. So in late September when the *W. F. McCrady* was delivered by the St. Louis Shipbuilding and Steel Company, her builders, the new owners had a chance to see the results.

The new boat is an all welded steel twin screw vessel with 3/8-inch hull plate. She is 78 feet long, with a beam of 24 feet and a depth of 8 feet 3 inches. Her draft is 5 feet, nine inches. Hull tanks provide for a fuel capacity of 10,000 gallons and a fresh water capacity of 1,500 gallons—plenty to meet the requirements of the owners.

Her power plant incorporates the latest in river tow boat design including Kort nozzles. The main engines are a pair of National Supply Co. Superior Diesel engines, 6 cylinder, 8½ by 10½ bore and stroke, rated at 270 hp. each at 750 rpm. These engines drive a pair of 60-inch 4 blade bronze propellers through Falk reverse and reduction gears at a ratio of 2.75 to 1. The propellers are designed to absorb 250 hp. at 272 rpm. when towing at 5 mph. The Falk gear is equipped with Airflex clutches for ahead or reverse operation. Engine controls were supplied by Westinghouse Airbrake Co. and are fully pneumatic. There is one lever for each engine which controls the speed of the Diesel from full ahead to full astern. These controls also include start and stop push buttons. Identical sets of engine controls are located in the pilot house and engine room. When engine room controls are used the pilot house control is made inoperable at the engine room control stand. For compressed air supply there are two 4-cubic foot Quincy compressors, one motor driven and one engine driven, with two air tanks for storage.

Main engine and auxiliary cooling is accomplished by built-in skin-type coolers which circulate engine cooling water through coils set at the skin of the ship. This is standard with ships of St. Louis Shipbuilding and Steel Co. construction and makes a compact installation.

Auxiliary electric power is provided by a 10 kw. 125 volt DC tailshaft Generator, V-belt driven by the starboard main engine. The

W. F. McCRADY--New Diesel Towboat

By GEORGE D. CROSSLEY

auxiliary generator set is a General Motors, 2-cyl. Diesel driving a 20 kw. generator.

An Exide marine storage battery system floats on the line; it is a 56 cell, 112 volt set-up rated for 290 amp. hours at an 8 hour rate of discharge. Electric power is very adequate.

The forged steel propeller shafts were furnished by Heppenstall Co. and are supported on Medart bearings; the stern tube bearings are bronze and the stern strut bearings are Goodrich Cutless Rubber. The two, all important steering rudders and the four backing rudders are controlled by electro-hydaulic steering gears of the builder's design. The gears are of the electric follow up type in which the position of the steering levers in th pilot house indicate the position of the rudders.

The *W. F. McCrady* is well equipped with auxiliary gear. A 100 gpm fire pump driven by a 7½ hp. motor is installed which can be used as a barge pump if necessary. A Carter bilge pump of the centrifugal type is installed.

Engine room noise is reduced considerably by Maxim exhaust silencer installations and by Air Maze and Burgess snubbers for intake air. The all welded steel deckhouse, Texas and Pilothouse are insulated with 2-inch Fibreglass and lined with ¼ inch asbestos board. The main deckhouse, going aft includes a deck stores locker, a crew wash room, crew quarters, crew lounge, engine room with gallery walkway to galley, galley cook's room and bath and steering engine room. Aft of the pilot house is the Master's and Pilot's room which is the full width of the Texas. Still further aft is the officers' wash room on one side and the engineer's room on the other. The quarters house eight men and a woman cook.

78-foot Diesel Towboat "W. F. McCrady" packs 540 hp. in her small hull.

SUPERCHARGED DUAL FUEL ENGINES FOR OIL FIELDS

TWO independent developments in the design of Diesel engines have widened the application of the Diesel in drilling oil wells. Combined in one engine recently by The National Supply Company, Superior Engine Division, both turbo-supercharging and dual-fuel operation have now been applied successfully in well drilling.

Dual-fuel engines, a number of which have been operated in Texas and Wyoming permit a long needed flexibility of engine operation on either oil or gas. These engines are convertible from one fuel to the other by the movement of a single lever while the engine is running. Their use avoids the common practices of (1) stocking two engines for the same service or (2) of moving and storing conversion accessories, which require considerable time and labor to convert a Diesel engine to a spark-ignition gas engine or the reverse, when fuel conditions require. An important advantage of this dual-fuel engine design is that the necessary accessories can be added at any time to Superior Diesels already in service. They add about 10 per cent to the cost of new engines and negligible weight.

Supercharging increases the power output of a Diesel engine as much as 60 per cent or more with only about 15 per cent increase in weight. The weight per horsepower is reduced about 40 per cent. Trends toward greater depths of oil and gas wells, more powerful drilling rigs and other factors increase the need for minimum weight of drilling engines.

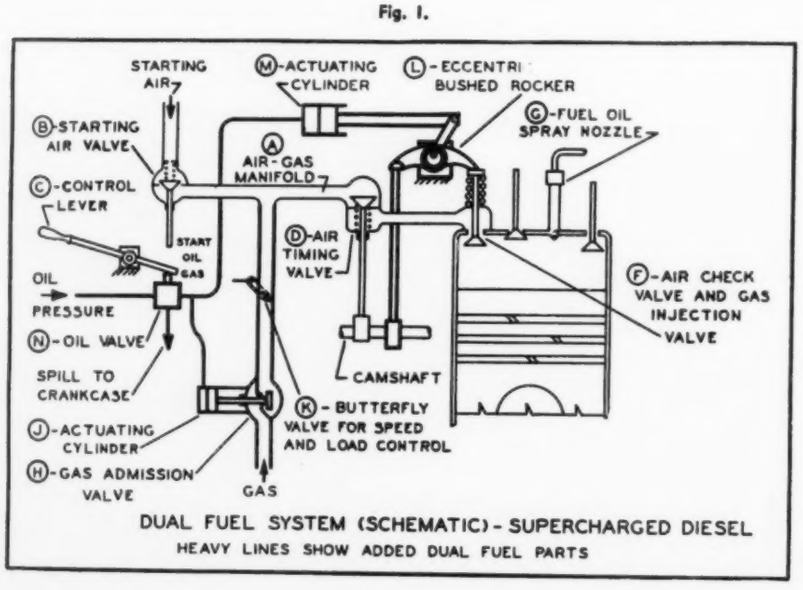
Field tests of a turbo-supercharged, dual-fuel engine drilling in a California oil field demonstrated the flexibility and fast getaway of the engine under actual drilling conditions. The engine responded quickly to the throttle with either heavy load or empty blocks, the turbocharger introducing no lag in rig performance. Anticipated fuel economies of dual-fuel operation were shown, exceeding at full load the well known high efficiency of the straight Diesel engine. Supercharging increased engine power with only slight increase in cylinder pressure and negligible increases in crankshaft and connecting rod bearing pressures. This is because higher average pressure is maintained during the power stroke. Little more cooling capacity is required because considerable heat is dissipated by the scavenging air.

Superior engines are supercharged by the Elliott-Buchi turbocharger, which consists of a gas turbine operated by engine exhaust gas on its way to the atmosphere and has no connection with the engine crankshaft. A blower on the atmosphere and has no connection with the engine crankshaft. A blower on the same shaft with the turbine supplies scavenging and combustion air to engine cylinder at a pressure greater than that of the atmosphere. Speed and output of the turbocharger vary automatically with engine speed and load, or both, making control equipment unnecessary.

The principle and application of dual-fuel operation is new only to the rotary drilling of oil wells. In Dr. Diesel's original patents the burning of liquid, gaseous and even solid fuels on the more efficient high compression cycle was considered. The dual-fuel engine was developed in Europe several years ago when liquid fuels became scarce and combustible by-product gases were available. Variable availability and fluctuating prices of fuels have influenced the development of dual-fuel engines in the United States. National Supply Company, recognizing the value of this flexibility in its drilling engines, as well as in other service, devoted a considerable research program to developing its own individual fuel systems.

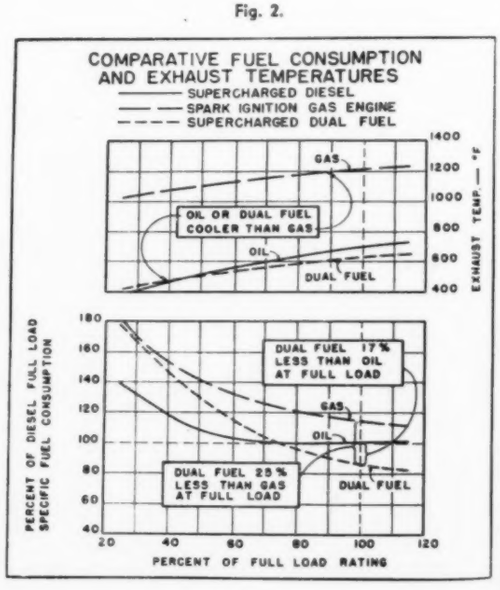
It has been demonstrated that gas alone does not ignite regularly at the compression pressures and corresponding ignition temperatures in conventional Diesel engines. Consequently in gas operation it is necessary to burn also a small proportion of oil as a pilot fuel for igniting the gas. A fixed quantity of pilot oil, equivalent to 10 to 15 per cent of the full load oil consumption, must be used under the conditions of intermittent operation of drilling engines, although lesser amounts can be used

Fig. 1.



DUAL FUEL SYSTEM (SCHEMATIC) - SUPERCHARGED DIESEL
HEAVY LINES SHOW ADDED DUAL FUEL PARTS

Fig. 2.



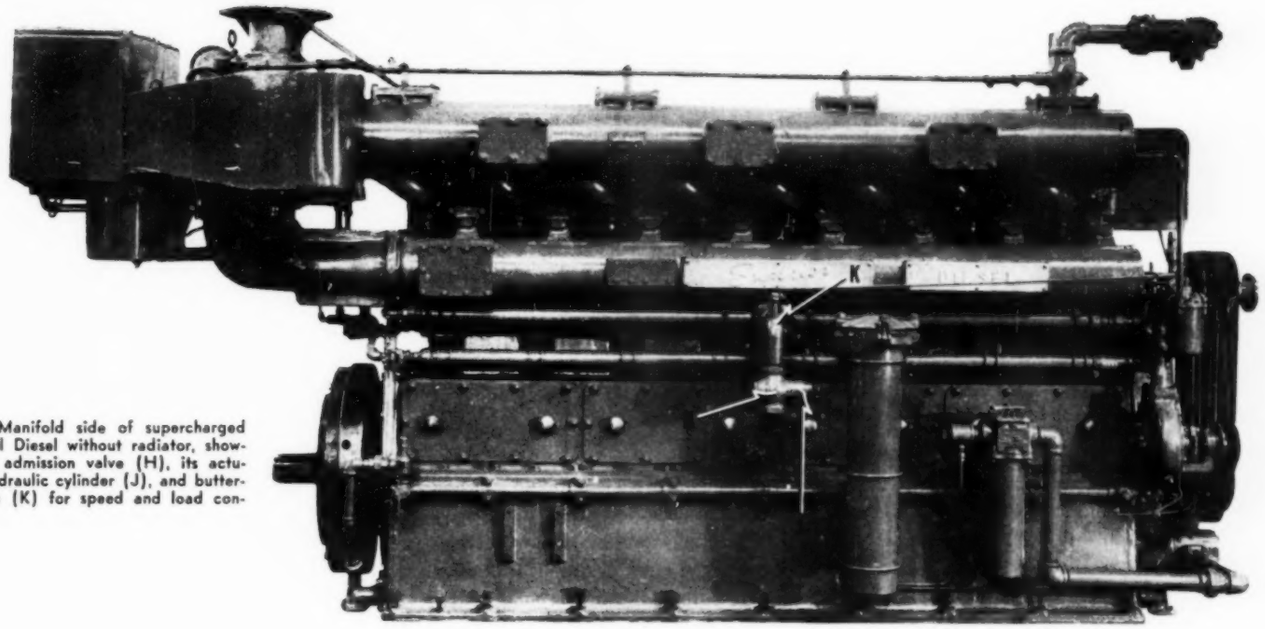


Fig. 3. Manifold side of supercharged dual fuel Diesel without radiator, showing gas admission valve (H), its actuating hydraulic cylinder (J), and butterfly valve (K) for speed and load control.

under laboratory conditions of operation. The actual ratio of gas to oil varies with engine load. Thus gas consumption may vary from a few per cent at idling loads to about 87 per cent of the total fuel at full load.

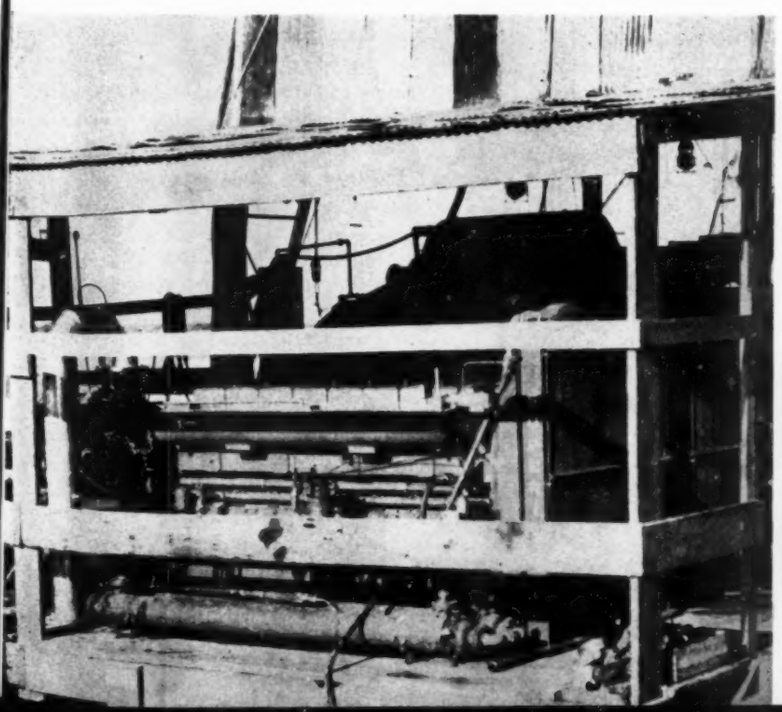
The problem of introducing gaseous fuel into a supercharged dual-fuel engine, created by scavenging at the end of the exhaust stroke, was solved by a novel gas-injection system. In this system, shown diagrammatically in Fig. 1, the starting air check valve for dual-fuel engine operation is used for injection of gaseous fuel. This makes the heads of straight Diesel and dual-fuel engines interchangeable.

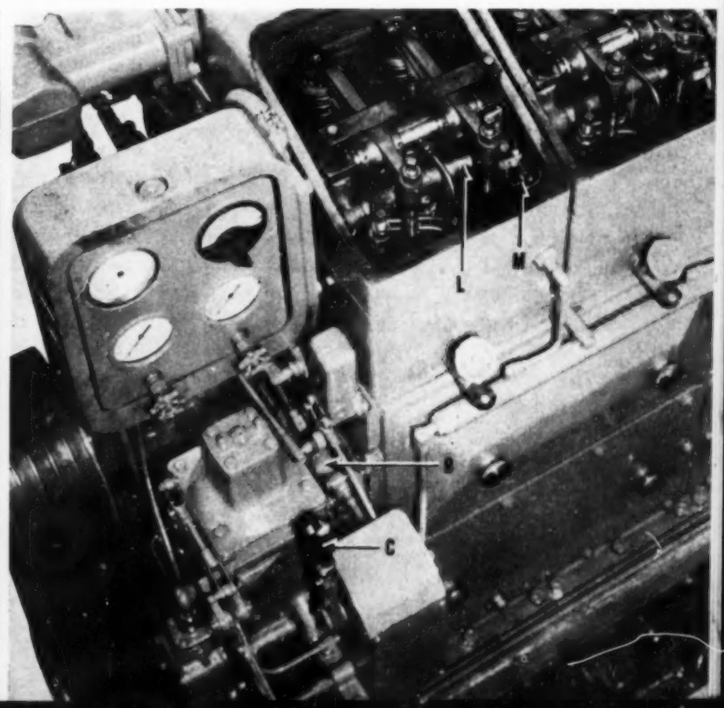
To start the engine the control lever (C) in Figs. 1 and 3, is thrown to starting position. This admits starting air under pressure to the manifold (A). While the engine is starting the gas valve (H) in Figs. 1 and 5 is closed and the hydraulically actuated eccentric bushing (L) disengages cam control of the air check valve (F), allowing it to act simply as a spring loaded check valve. High air pressure forces the air timing valve (D) down against the camshaft to time admission of starting air to the cylinder. After the engine is started, the control lever (C) is moved to an intermediate position which prevents both starting air and gas from entering the manifold and the engine burns oil.

If dual-fuel operation is desired, the control lever (C) is moved farther to open oil valve (N) which actuates the hydraulic cylinders (J and M) on gas admission valve (H) and eccentric bushing (L). Gas is then admitted to the starting air manifold where it is controlled by butterfly (K) and injection valve (F). The air timing valve (D) remains open because the gas pressure is not sufficient to force it down on the cam against its spring. The fuel consumption of the supercharged dual-fuel engine as compared with the straight supercharged Diesel and conventional spark-ignition gas engine is shown graphically in Fig. 2. Both the straight Diesel and dual-fuel Diesel are shown to be more efficient than the spark-ignition gas engine under normal conditions.

The dual-fuel engine is even more economical than the straight Diesel at loads greater than 75 per cent of full load, and at full load this saving amounts to about 17 per cent. It is interesting from a technical point of view that the relatively high percentage of pilot oil results in better economy than when minimum pilot fuel is used under controlled conditions. The comparison of exhaust temperature in Fig. 2 is also significant.

Fig. 4. Below, left. Supercharged dual-fuel Diesel tested on rotary drilling rig drive in California. Fig. 5. Controls and rocker assemblies showing starting air valve (B), control lever (C), eccentric bushed rocker (L), and its actuating hydraulic cylinder (M).





IS FUEL A MAJOR FACTOR IN THE SMOKELESS OPERATION OF A LOCOMOTIVE OR A STATIONARY DIESEL?*

By RENE J. BENDER**

IN June, 1942 a paper was presented at the annual meeting of the Smoke Prevention Association at Cleveland, titled, "Influence on Atmospheric Pollution of the Exhaust and Diesel Automotive Vehicles and Locomotives." For the preparation of that paper many people were interviewed on whose shoulders rested the responsibility of designing Diesel equipment and of maintaining it in good running condition: engine manufacturers, service managers, railroad master mechanics, shop foremen, and truck operators. Their reactions varied as to the causes of smoky or acrid exhaust gases from their engines, but they unanimously agreed to a conclusion that was adopted as the basis of the paper, namely that "The exhaust gases of a Diesel-powered locomotive or automotive vehicle will contain no visible smoke nor any offensive invisible products, providing the engine is maintained in a satisfactory mechanical condition, providing the correct Diesel fuel is used, and providing the operator knows how to handle his engine correctly."

The causes of visible smoke in exhaust gases were listed in a tabulation which is reproduced here in Table I. Obviously the causes of visible exhaust smoke have not changed in the last four years, although a better understanding of the processes leading to white, gray or black smoke has been acquired. But considerable progress has been made towards the abatement of smoke and while, as a whole, the statements contained in the 1942 paper are as up-to-date now as they were then, a more optimistic outlook is permitted today.

In their paper on the subject of, "Effect of Diesel fuel on exhaust smoke and odor" presented at the Peoria Oil & Gas Power Conference of the A.S.M.E., also in June, 1942, Messrs. Wetmiller and Endsley of the Texas Company reported their interpretation of an intensive study of the behavior of 72 fuels in several Diesel engines, and one of their conclusions is of particular interest in the light of what has taken place since then: "No doubt," they say, "future engine design will obviate the necessity for tailor-made fuels and precise maintenance practices."

That statement can be taken as representative of the attitude of the fuels and lubricants produ ers. They feel generally that the engine manufacturers, the boiler makers, the designers of oilburners and heating equipment should adapt their equipment to the fuels and lubricants available in the country and in the world at large. They should not expect petroleum products to be made, at an expense often unjustified, to suit a somewhat stagnant design of equipment. That such a conception is quite legitimate is dramatically illustrated by the example of the Central European countries during the recent war. Their fuels and lubricant supply was most uncertain, their specifications most erratic. But manufacturers of engines were instructed to design mechanical equipment that would perform satisfactorily regardless, and we discovered that they did a pretty successful job.

American manufacturers agree with such a theory to a point only. "Let us know," they tell the refiners, "what the fuels of 1947-48 will be and we shall be entirely capable of building our equipment to make the most efficient use of these." But they feel impatient when they realize that the refiners are nothing less than certain of what kind of an answer they can give to such a query. To fully understand why that condition exists it must be understood that the art of refining is one of extreme flexibility; that flexibility, however, tends to give it a most puzzling aspect. In this modern world of catalysts and synthesis, where the dream of the alchemist has almost become a reality, and when most any substance can be produced with any other as raw material. the refiner finds himself in a quandary equally as confusing as the equipment manufacturer. "What is the trend in refining?" wonders the mechanical engineer? "What is the trend in mechanical design?" retorts the refiner.

At the end of World War II, and on the basis of the eminent success of catalytic cracking for the economical production of high octane gasoline, most refiners had under way a huge program of construction of catalytic cracking plants, now in full swing. Thermal cracking, the conventional cracking method for the past 25 years, is generally to be used in conjunction with "cat" cracking as long as the thermal crackers would last. Such equipment makes possible almost endless combinations, or cycles, of straight-run (or uncracked) products, any proportion of cat-cracked distillates, and any amount of distillates from the can-cracking plant rerun into the thermal cracking stills. Table 2 gives a comparison of the proportions of various products obtained just before the war and now.

Very summarily the following fundamental differences can be listed:

a) The proportion of higher octane gasoline will be greater thanks to catalytic cracking.
b) Less lead will be required to accomplish the same result.
c) A tendency towards less straight-run distillates is apparent.
d) Greater quantities of cracked distillates, with lower volatility, heavier weight, and lower cetane number, will be produced.
e) A reduction of residual fuels will result from the above conditions.

But, as mentioned above, such proportions are by no means immutable and, providing there is a definite demand for them, almost any combination can be obtained—at a price: What then, will be the demand?

Will it be mostly for high-compression automobile engines requiring gasolines of 80-octane or higher? Will it be for jet-propelled aircraft,

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* *Paper presented at National Meeting of the* Oil and Gas Power Division, A.S.M.E., May *21-24, 1947 at Cleveland, Ohio.*

** *Asst. to Chief Consulting Engineer, Sinclair Refining Company, New York, N. Y.*

necessitating a light distillate participating of the properties of naphtha, gasoline and kerosene, regardless of octane number?

Will it be for gas turbines and, if so, what type of fuel will become the most economical for that new species of prime mover? Will the Diesel hold its own place in spite of all that competition, and should development be intensified towards more effective Diesel fuels? Will domestic heating increase the demand for heating distillates as much as seems to be indicated now, or will liquefied petroleum gases play a decisive part in the picture? Will oil burners of large capacity be developed for the efficient utilization of heavy residual oils or should a lighter and easier to handle distillate take the place of the so-called "Bunker Oils" in many cases? These are just a few questions that confront the Oil Refiner when he attempts to formulate a program for his fuel production for the near future. And, to these questions, the Equipment Manufacturer has no immediate answers.

A bright light, however, seems to be showing in this darkness since experimental work started with certain chemical additives which, mixed in very small concentration with the fuels, may be found to impart to them some of the qualities required for a definite purpose. For example a cat-cracked distillate may be turned into a satisfactory Diesel fuel by addition of a small proportion of Amyl Nitrate, as reported in C. M. Larson's paper presented at the Fall Meeting of the S.A.E. at Tulsa in November 1945, titled: "Diesel Additives Create New Concepts." Similarly chemicals are being developed which, added to the same cracked distillate may make it suitable for use in oil burners of the vaporizing type. It may therefore not be out of line to envisage the popular use of one, or preferably two, cat-cracked and, at least temporarily, partly thermo-cracked distillates which, thanks to the ingenious use of additives, will be highly satisfactory for a wide scope of applications. These fuels, with their proper additives, will be used as efficient Diesel fuel, Domestic Heating distillate, Gas Turbine Carburant, and Industrial and Naval Burner Fuel Oil. One of their essential requirements will be that either by virtue of their own composition or by the catalytic action of their additives, they will provide smokeless combustion in Diesel engines and form no carbon deposits on the pots of vaporizing burners.

A further development which may throw an entirely different light on the Diesel fuel picture is the production of petroleum products synthetically. Using gas, or even solid fuels, as raw material, gasoline of high octane quality and Diesel fuel of high cetane number will be made in the near future, at costs in line with those of the conventional processes of today. This rather long, but necessary, digression was made in an endeavor to explain that all evidence points to the fact that fuel oil, by its very nature, needs not be considered as a major factor in smoke production, especially in the field which we are considering in this paper, which covers only locomotive and stationary Diesels.

But even if we absolve the fuel as a contributing factor of smoky exhaust in Diesel engines operation the other causes of smoke listed in Table 1 must be considered, and remedies thereto must be developed.

These remedies can be of three sorts:

A. Better Design
B. Better Maintenance
C. Better Operation

A. Better Design—Perhaps the most outstanding step toward smoke elimination in Diesel engines, since the writer's 1942 paper, is the adoption by the Manufacturers, of a more conservative method of rating their engines. To the efforts of the Bureau of Ships of the Navy must be given a great deal of credit for having brought about such an improvement. Today, according to all the Railroad and Naval personnel interviewed, a 1000 hp. Diesel engine will develop a steady 1000 hp., under no specially selected conditions. No longer is an operator, questioned about the smoky exhaust of his truck justified in saying, as it was reported in 1942: "A Diesel engine always smokes when you push it to its full power."

Another improvement in Diesel-Electric Locomotive design, with a decided influence upon smokelessness, is a better load regulator, which is the electro-mechanical connection between the Diesel throttle and the electric generator in the locomotive. To use one of the latest designs as an example, Figure 1 is the Pilot Valve Operating Diagram of the Electro-Motive Vane type Load Regulator. This load regulator is an automatic control device which allows the engine to determine the load which it can pull based on fuel consumption. It is divided into two sections: the pilot valve which is attached to the governor, and a self contained unit in a structural steel frame consisting of a hydraulic rotary vane type motor attached to a stationary commutator type rheostat.

If the engine demands more fuel than a predetermined setting, the load regulator reduces the load on the engine by reducing the field excitation of the main generator. If the engine requires less fuel than the predetermined setting or balance point, the load regulator increases the load on the engine by increasing field excitation of the main generator. In this manner, battery voltage, temperature changes in generator windings, or locomotive speeds do not cause overloading or underloading of the engine.

If the throttle is moved, the governor power

Pilot valve operating diagram of Electro-Motive vane type load regulator.

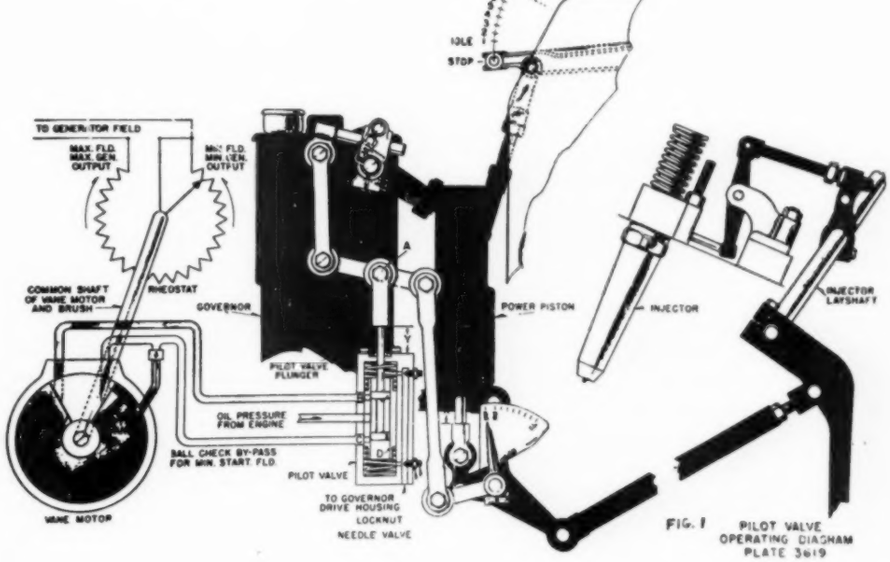


FIG. 1 PILOT VALVE OPERATING DIAGRAM PLATE 3619

piston moves to maintain the new speed of the engine. The point "A" Figure 1, at which the pilot valve is connected to linkage between the throttle and the injector will remain stationary, except when a new demand is made on the engine due to a generator load. If the engine demands more fuel than is normal for the throttle position that the controller is in, the governor power piston will raise.

Since the throttle has not moved, the pilot valve plunger will be raised allowing oil under pressure to flow to the load regulator through the port "B," turning the vane motor. Oil trapped on the opposite side of the vane will be forced back to the pilot valve through port "C," and push up on the bushing shoulder "D." This would prevent further flow of oil through the upper port "B" unless the needle valve was open to allow the oil to dump into the governor drive housing. By turning the vane motor and rheostat, the resistance of the battery field circuit is increased, thus reducing the output of the generator. This lessens the load on the engine and allows it to pick up speed to its original throttle setting. With the speed back to normal, the governor is satisfied and the power piston drops into its normal position.

A third fundamental step towards smokelessness is related to the turbo super-chargers of the engines; as the bulk of the air required for combustion is supplied to the cylinders by the super-charger, and as the super-charger is driven by the turbine actuated solely by the exhaust gases, it follows that on many older models a decided air starvation was taking place when the engine was idling because there was not enough exhaust gas velocity to supply enough air, and smoke was one of the consequences. On later models this difficulty has been obviated by installation of proper by-passes and dampers.

Tests conducted recently on the dynamometer and in the field, and which will be reported in details elsewhere, seem to indicate that the propensities of a Diesel engine to smoke at certain speeds, at certain loads, or under certain operating conditions such as acceleration or deceleration, are much more closely tied up with the design of the engine than with the nature of the fuel. These tests, repeated with a great variety of fuels ranging from heavy distillates to light kerosene, and with cetene numbers varying widely, also seem to prove that no one fuel will be consistently smokeless or consistently bad over the entire range of engine operation, neither will one fuel be consistently the most economical over that range.

B. Better Maintenance—In an appendix to the 1942 presentation, a routine maintenance program for a large Bus Company was illustrated. Preventive Maintenance has made immense progress in Railroads. An original idea used by the Electro-Motive Division of General Motors Corporation is a "Slide-Rule" type of Maintenance Chart; the fixed portion can be prepared either for a given number of miles, as most convenient to each individual case. The slide shows a list of operations to be performed: inspection, lubrication, tightening, cleaning, and so forth. Use of this Chart assures that no maintenance operation will be overlooked and that proper intervals will be respected by engineering personnel.

Maintenance of stationary Diesel power plants still leaves much to be improved upon. The large power plant, of the municipal or public utility plant is usually favored with the kind of technical personnel fully aware of the importance of preventive maintenance. But in the smaller industrial plant, the Diesel installation is frequently neglected through lack of proper supervision, or failure to realize what correct maintenance means to the management, as well as to the community That is where "smoky" Diesels can still be found.

It is greatly to be desired that Diesel plant operators acquaint themselves with the use of a number of simple testing devices such as "Pressure Indicators" and "Thermocouples" to check the operation of each individual cylinder; "Injector Testing Bench" to check the operation of the delicate injection system; "mikes" to measure the eventual wear of cylinder liners, pistons and rings; "feelers" to check bearing clearances; "Viscosity comparator" to keep an eye on the quality and the dilution of the lubricating oil.

The importance of avoiding "cold engine operation" which is decidedly conducive to smoke as well as to uneconomical performance, is being realized by an ever-increasing number of operators. Diesel locomotives tend to give off some smoke at initial acceleration after long periods of layover or engine idling at terminals. However, this effect is minimized to a large extent by keeping the Diesel engine cooling water temperature up within operating range. This is done mostly by piping the boiler supplying steam for train-heating to the Diesel engines, so that steam may be admitted to the cooling water during idling periods.

C. Better Operation—Emphasis on better operation has become evident throughout the industry, yet much remains to be done in that direction. Manufacturers of Diesel engines, conscious of the fact that a better understanding of Diesel equipment will lead to better operation and contribute to greater Diesel popularity, are promoting educational programs for the small operators who cannot afford large sessions within their own organizations.

Well-balanced training programs are either in progress or in project throughout the country, among users of Diesel engines, among constructors, and among oil companies. Diesel engines are multiplying at a rate truly spectacular and the public at large is becoming increasingly conscious of the prestige of the Diesel engine.

TABLE I

CAUSES OF VISIBLE SMOKE IN EXHAUST OF DIESEL ENGINES

I—IMPROPER PROPORTIONS OF AIR AND FUEL

A—*DEFICIENCY OF AIR*

1—Altitude
2—Temperature
3—Dirty air cleaner
4—Obstructed air passages
5—Defective supercharger

B—*EXCESS OF FUEL*

1—Worn injection pumps or injection nozzles
2—Dirty injectors
3—Injection timing or balancing out of adjustment
4—Fuel limit control incorrectly set
5—Overloading due to inexperienced operation

C—*PRESENCE OF LUBRICATING OIL ABOVE PISTON*

1—Sticky piston rings
2—Worn sleeves
3—Broken pistons
4—Fumes or droplets of oil in air

II—LACK OF TEMPERATURE

D—*LOSS OF COMPRESSION*

1—Sticky and leaky valves
2—Sticky and leaky piston rings
3—Worn sleeves

E—*EXCESSIVE COOLING*

1—Prolonged idling
2—Temperature control neglected

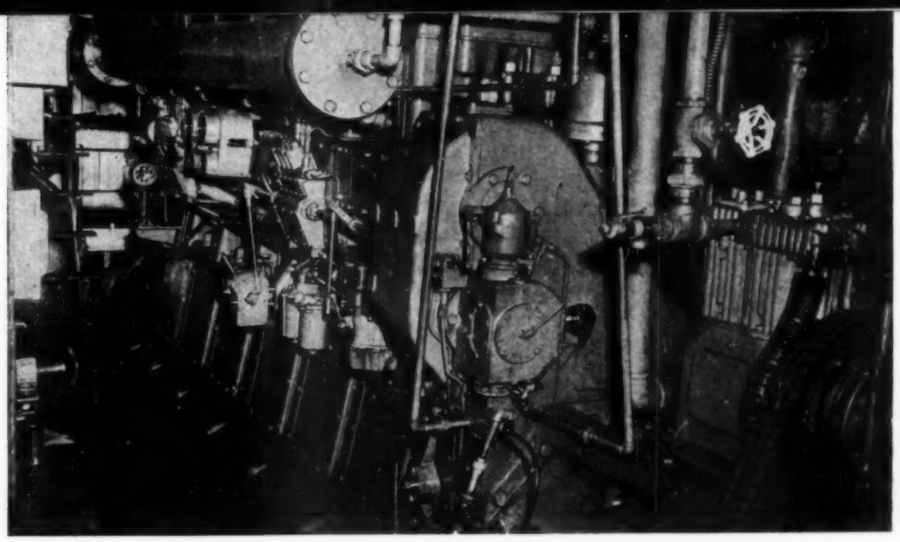
III—IMPROPER MIXTURE AND IGNITION OF AIR AND FUEL

1—Basic design of combustion chamber
2—Worn or dirty injection parts
3—Improper Diesel Fuel

TABLE 2

TYPICAL YIELDS FROM CRUDE

	PREWAR Percent	POSTWAR Percent
Gasoline, including Aviation gasoline	44	42
Lubricants	3	3
Kerosene	6	5
Distillates	12	15
Gases	3	4
Residual Oils	28	25
Miscellaneous	4	6
Total	100	100
Crude Consumed in U. S. A.:	**1935**	**1945**
Yearly Barrels	999,804,000	1,754,100,000
Daily Barrels	2,739,200	4,805,800



Engine room view of repowered vessel showing 515 bhp., 400 rpm. Cooper-Bessemer Diesel recently installed.

Repowered Menhaden Boat *GEORGE H. McNEAL III*

By WALTER F. MYERS

Six-year-old George, aboard the fishing boat which bears his name.

ON Saturday afternoons Master George H. McNeal, III, age six, goes down to the dock with his father George H. McNeal, Jr., to watch the McNeal Company's four menhaden boats come in and unload for the week-end tie-up. His interest centers on the *George H. McNeal III*, renamed for him in 1942.

Originally christened the *Dolphin*, the vessel was launched at Pocomoke City, Maryland, in 1908. Steam power was employed in the vessel until 1942 when Diesel was installed. In September, 1946, engineers were called in by the McNeal Company to consider repowering the *George H. McNeal III*. The McNeal Company ordered a Cooper-Bessemer 6 cylinder, 13 in. bore, 16 in. stroke engine. Swinging a 64 in. x 42 in. Columbian 3-bladed type MI wheel, the engine is rated 515 bhp. at 400 turns.

The *George H. McNeal III* is 128 ft. x 19.7 ft. with a depth of 9.4 ft. The vessel is registered as of 181 tons gross and 71 tons net. With a net weight of 44,000 lbs., the new Cooper-Bessemer is 15 ft. 1½ in. l.o.a. with a width between holding-down bolts of 41 in. and an overall height above the crankshaft centerline of 6 ft. 3 in. The installation employs 18 ft. of 6¾ in. steel intermediate and tailshaft running in a lignum vitae stern tube bearing.

Installation of the new engine was completed by the McNeal Co., under the general supervision of L. B. Hume of Cooper-Bessemer's Washington, D. C., office and G. L. Collar. Dock trials were held at the Moon Shipyard & Repair Co., in Norfolk, Va., and on May 14, 1947 the vessel stood down the Elizabeth River on sea trials. The new Diesel was turned at all speeds between 175 and 430 rpm. At the normal rated engine speed of 400 rpm. the vessel averaged better than 12 knots over a measured course off Sewall's Point, Norfolk, Virginia.

George Herbert McNeal, Jr., was elected President of the McNeal Co. in 1942. T. Carlyle McNeal is Vice President and Plant Manager, and Aleta D. McNeal, Secretary and Treasurer.

The McNeal Co., organized in 1929, acquired the property and plant of the original C. E. Davis Packing Company at Fairport, Va. which it has expanded and successfully operated for the past 18 years.

Skipper of the *George H. McNeal III* is Captain Leonard D. Brown of Mathews, Va.; serving as pilot is Captain E. F. Brooks. Chief Engineer on the *George H. McNeal* is Leon Hudgins with assistant James Godsey. Boats other than the *George H. McNeal III* being fished by the McNeal Co., include the *Henry W. Conant*, the *E. Warren Reed*, and the *Peconic*.

Features of the new Cooper-Bessemer engine in the *George H. McNeal III* include Meehanite castings throughout, including pistons and liners; the patented Cooper-Bessemer pressure relief system of fuel injection, four valve cylinder heads, providing for future turbocharging and a supplementary forward end flywheel for balancing out critical vibrations throughout the operating range of the engine.

The menhaden industry had its beginning in the Reedville area about 1870, and has grown steadily until it is now one of the largest industries on the Atlantic Seaboard. It is estimated that 200 vessels are now employed in harvesting the menhaden. The menhaden vessels average 125 ft. l.o.a. by 21 ft. beam by 10 ft. deep. Originally all the vessels were steam-powered. Today, nearly all of them are Diesel-engined. Principal products of the menhaden reduction process are fish scrap, fish meal and oil, is essential in the preparation of poultry and other patented animal feeds. The oil is used largely by paint and soap manufacturers.

Towards Lighter, More Powerful Diesel Lo

By F. H. BREHOB*

DURING World War II, intensive development and improvements took place in the Diesel-engine industry with the result that the Diesel-locomotive builder is now producing a better locomotive suited for main-line service. Further improvement in the power-weight ratio is being sought in order to further improve the suitability and economy of operation at higher speeds required today.

The first commercial Diesel-powered switching locomotive was built in 1925. It had a 300 hp. engine and the completed locomotive weighed 60 tons, thereby providing five hp. per ton of locomotive weight. This relatively low power-weight ratio made the locomotive suitable for switching service where the speeds are low even though that locomotive could not economically have been built to weigh less than 60 tons. This weight came about due to the use of a rather massive low-speed engine weighing about 65 lb. per horsepower. The electrical equipment was considerably heavier than modern equipment built for equal duty, all of which contributed toward making the basic locomotive weigh 60 tons.

A modern Diesel locomotive for main-line service has 13 to 14 engine horsepower per ton of locomotive, which approaches three times the power per ton of the first switcher. Nevertheless, greater horsepower per ton can be utilized at increased speeds.

The horsepower at the rail may be expressed by the following formula:

$$\text{hp.} = \frac{\text{TE} \times \text{Speed}}{375}$$

TE equals pounds tractive effort and the speed is given in miles per hour.

This formula may be further simplified to express engine horsepower. Approximately 5% of the engine output will be required for driving the auxiliaries such as the compressor, fans, for the lighting load and control load. A reasonable generator efficiency of 94% may be assumed and 90% as a reasonable traction motor efficiency in the normal operating speed range. The transmission losses between the generator and traction motor may be ignored as they are small. The engine horsepower then may be expressed by the formula:

$$\text{Engine hp.} = \frac{\text{TE} \times \text{Speed}}{375\,(1\text{-}.05) \times .94 \times .90} = \frac{\text{TE} \times \text{Speed}}{300}$$

Assume a high-speed freight locomotive operating at 0 mph. which could produce a tractive effort equivalent to 25% to 30% of the weight on drivers at starting, but which admittedly cannot maintain this high starting tractive effort at the high speed, due to wheel slipping. The locomotive should however be able to operate at 60 mph. with a tractive effort equivalent to 10% of the driver weight. On this basis, the engine horsepower per ton on drivers would be

$$\frac{2000 \times .10 \times 60}{300} = 40$$

Considering practical railroading, a locomotive which might run normally at a maximum speed of 60 mph. should be capable of using full engine horsepower at a much lower speed of, e.g., 25 mph. At this speed it is reasonable to obtain 17% to 18% for rail-to-wheel coefficient of adhesion. Using the same formula, engine horsepower per ton on drivers would be:

$$\frac{2000 \times .17 \times 25}{300} = 28.4\text{-hp.}$$

Rounding out this figure, 30 hp. per ton could be used for a locomotive which normally operates at a top speed of 60 mph. and which would still utilize the full engine horsepower down to 25 mph. without excessive wheel slipping. Using the above proportions for any other class of service, it may be said that the engine horsepower per ton which can be used is equivalent numerically to about 50% of the top operating speed in miles per hour.

The foregoing statement is further illustrated in the following table:

Classes of Service	Switching	Transfer	Slow or Way Freight	General or Local Passenger or High Speed Main Line Freight	High Speed Passenger
Installed eng. hp per ton on drivers	7	10	15	30	50
Normal max. operating speed	14	20	30	60	100
Min. speed at which full power can be used limited by 25% adhesion	4	5	8	17	28

There may be differences of opinion as to whether the titles for the different classes of service aptly describe the services or whether the normal maximum operating speeds selected for the different classes of service meet all conditions, but the important thing to note is that, as speeds increase, increased horsepower can be used.

The line "Minimum speed at which full power can be used, limited by 25% adhesion" assumes all the weight on drivers and shows the lower limit of the speed range through which the locomotive might be operated under good rail conditions. It will be noted that this speed represents somewhat less than 1/3 of the normal maximum operating speed. Thus it may be said that, from zero speed to about 1/3 of the normal maximum operating speed, full horsepower can be utilized from 1/3 speed to the normal maximum operating speed if the locomotive be provided with the installed engine horsepower per ton indicated in the table.

For mountainous operation where it may be

* *Locomotive Engineering Divisions, General Electric Company, Erie, Pa.*

Locomotives

economical to operate at low speeds in order to eliminate helper service over short portions of the total run, the horsepower-per-ton figures may be considered too high, but it is believed that the high power-weight ratios would be economical on roads where the grades are easy.

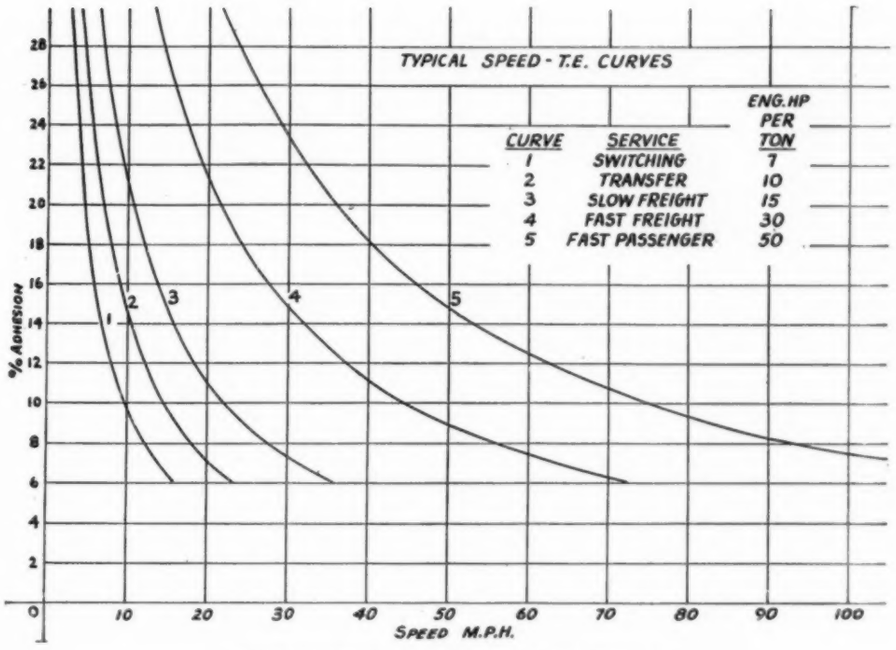
It will be seen from the table that the power-weight ratio changes appreciably from one class of service to the next higher speed class, the increase ranging from 50% to 100%, indicating that radically different designs are involved for the various services.

The data in the table are shown graphically in Fig. 1 by various speed-tractive effort curves for the several classes of service plotted in terms of per cent adhesion per ton of locomotive weight on drivers against miles per hour.

If and when the locomotive builder can produce the higher-horsepower-per-ton locomotives indicated for the high-speed service, greater economy of operation may be expected because the higher-speed trains will not be burdened with more locomotive weight than is necessary.

In general, for maximum economy of operation, locomotives should be assigned only to that class of service for which they are suitable.

To illustrate this principle with extremes, a switching locomotive with only 7 hp. per ton would make a very poor high-speed locomotive because so much locomotive weight would have to be used to obtain sufficient horsepower to haul trains over the road at their proper operating speeds. Furthermore, the traction motors would have to be geared for the high-speed operation and, when used in switching service with the high-speed gearing, the motors would be subject to overheating. On the other hand, a high-speed road locomotive would be uneconomical for switching service because of its high engine horsepower which could never be utilized for the low-speed switching service. In some cases, however, it would undoubtedly be economical for some roads to have one class of



Typical Speed-Tractive Effort curves for Diesel locomotive.

locomotive perform rather widely ranging classes of service in order to avoid having to maintain and service too many different kinds of locomotives.

To further illustrate the economy of greater horsepower-per-ton, assume a typical eastern railroad handling a 1000-ton trailing passenger train with a 4000 hp. locomotive weighing about 300 tons. The train, plus locomotive, weighs 1300 tons. Assume that 12 lb. per ton train resistance and an operating speed of 82 mph., require 4300 engine horsepower, which is approximately the engine horsepower required in a so-called 4000 hp. locomotive, which is nominally rated on the basis of engine horsepower-to-generator for traction purposes. If it were possible to obtain a 75-ton locomotive equipped with 3750 engine-horsepower, the total train weight would be 1075 tons and under the same conditions would require 3550 engine-horsepower. This represents a 75% reduction in locomotive weight and about 13% reduction in engine horsepower. Instead of the locomotive representing about 30% of the trailing train weight it would be only about 7½%. This represents an extreme case, where such a light locomotive might be used on a road with negligible gradients.

On western roads the same weight of train would today be handled by a locomotive weighing about 450 tons where the locomotive weight approaches 50% of the trailing train weight. Increased horsepower-per-ton of locomotive would reduce fuel and maintenance expense. If a lighter locomotive could be used, the fuel expense would be reduced because the total train weight would be less. With less total train, less locomotive power is necessary and, consequently, maintenance expenses will be reduced as well as fuel cost.

Today a so-called 6000 hp. freight locomotive weighs about 460 tons. On a road where limiting grades permit, a freight locomotive powered at 30 hp. per ton, weighing 210 tons, which would provide 6300 engine horsepower could be used. The difference between 460 tons and 210 tons would result in a saving of 250 tons of locomotive weight. The railroad could then carry five more 50 ton cars. If these five cars had a revenue lading of 125 tons and at a revenue of one cent per ton mile there would be a gain of $125 in revenue on a 100-mile run.

To achieve increased horsepower-per-ton will probably increase the cost per ton of locomotive because of the increased requirements of the prime mover and transmission equipment, which are the costly items. However, the cost per horsepower will probably be reduced. This would decrease the capital investment required, since horsepower is a measure of producing ton-miles per unit of time and ton-miles is a measure of revenue.

If at all possible, the total locomotive weight

. . . . *And now please turn to page 76* . . . .

DIESEL LOCOMOTIVE CRANE

Diesel engined locomotive crane unloads wood. Hoisting and swinging operations are accomplished by mechanical drive.

Close up of crane cab. Recent conversion incorporated electric drive for propulsion.

WITH ELECTRICAL PROPULSION DRIVE

By THOMAS J. WOODS* and D. C. GRAY**

ELECTRICAL propulsion of locomotive cranes provides a faster and more efficient means of material handling than mechanically propelled cranes. In addition, maintenance costs are reduced. These facts have been proved by operating experience with the American Hoist and Derrick Company's newly designed 40-ton Diesel locomotive crane that was introduced nearly two years ago.

The crane incorporates many changes in mechanism and structure. The main hoist, boom hoist, and swing motions are mechanically driven from the Diesel engine through time-proved finger-tip air-actuated clutches. The travel motion provides high draw bar pull for car switching with smoothness and ease of control by means of electrical transmission. Since this electrification is the chief innovation in the crane design, some details may be of interest.

Tractive effort at the rail is developed by two Westinghouse totally enclosed traction motors driving the axles through enclosed single-reduction spur type railway gears. The motors are axle-hung using conventional waste-packed bearings and are of standard railway construction, designed for heavy duty service. Because of the high wheel loads encountered on a locomotive crane, it is necessary to drive only one axle per truck to develop the desired draw bar pull. The motor nose support is cushioned in rubber to provide for the truck and axle motions that occur during crane operation.

Power is transmitted from the generator on the rotating machinery deck to the motors on the trucks by means of a collector ring assembly.

The crane is powered with a General Motors 6-71 or Buda 844 Diesel engine direct connected to a Westinghouse type 189 traction generator.

This generator has a shaft extension to provide mechanical power for the hoist and swing motions. The traction generator is of the self-excited, shunt-wound type with battery booster field. It is designed to develop full engine output over a wide range of current output. The generator also has a special series field for starting the engine from a 36-volt storage battery. Control is of the magnetic type and consists of contactors, field resistor, and master controller. Direction control is secured by reversing the traction motor series fields with magnetic contactors. Speed control is obtained by varying the resistance in the generator shunt field with the master controller.

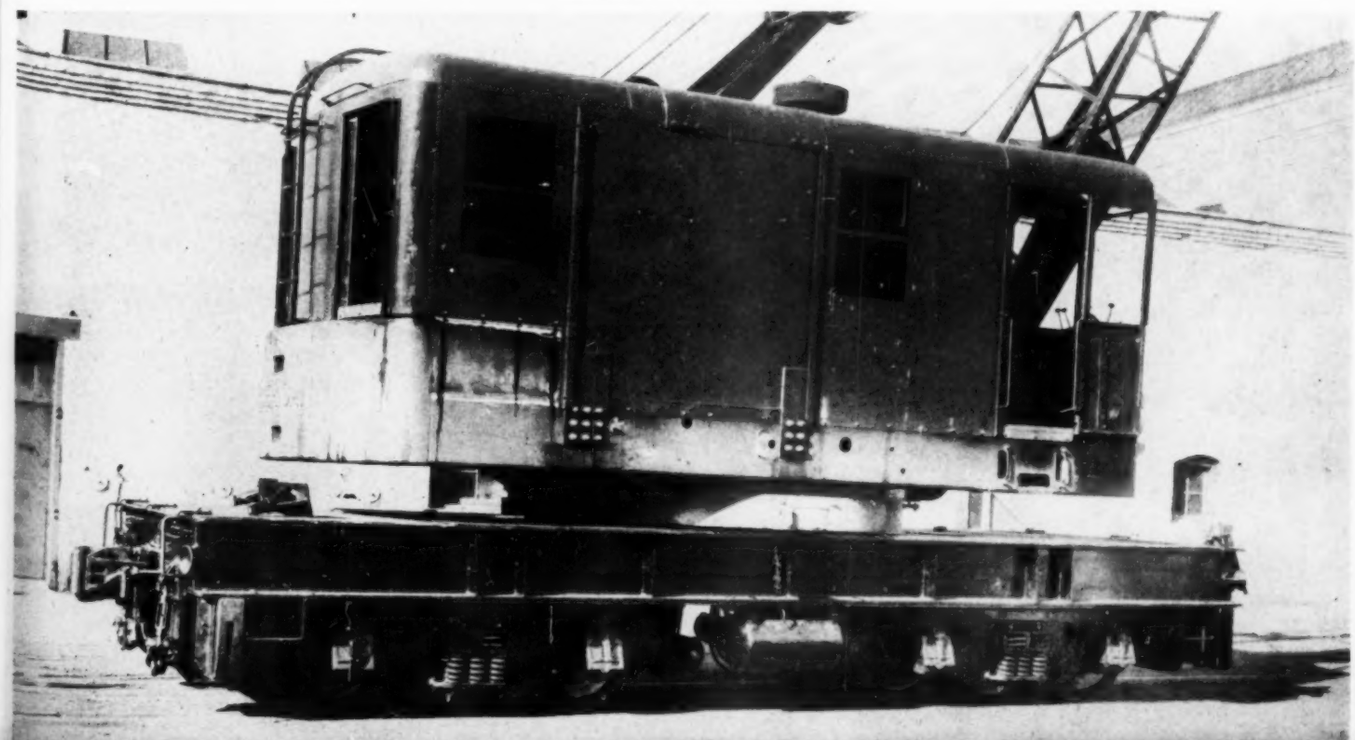
Simplicity has been emphasized in the design of the electrical system to provide the greatest possible reliability. Success of the electric drive has been assured by the use of electrical units which have been time-proved on Diesel electric switching locomotives.

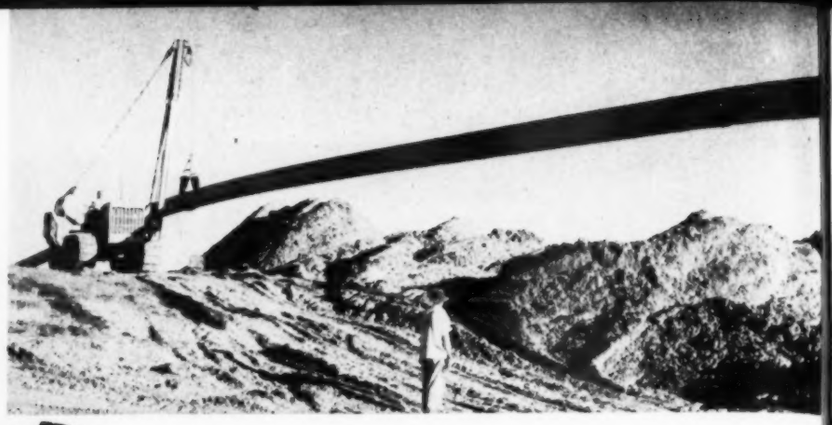
Field experience on a number of these cranes has demonstrated that electric traction will: 1) Develop a wide range of draw bar pulls and speeds with an ease and smoothness of control impossible by any other practical means of transmission; 2) Provide the smooth yet rapid acceleration so necessary when making frequent crane moves such as when handling wood; and, 3) Give much lower maintenance than a crane with mechanical transmission and its attendant clutches, bevel gears, and universal joints.

* *Industry Engineer, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania.*

** *Electrical Engineer, American Hoist & Derrick Company, Saint Paul, Minnesota.*

Side view of American Hoist and Derrick Company Crane which now combines the advantages of mechanical and electrical drive.



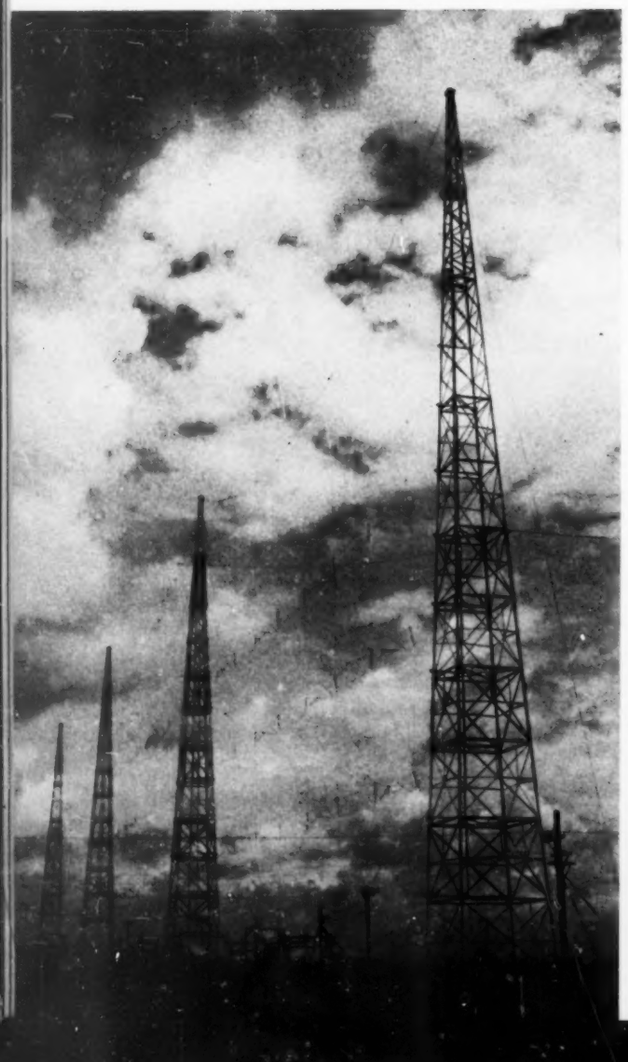


Horrigan Construction Co. uses Caterpillar tractor with pipe-layer boom to handle 240 feet of 20-inch pipe near Limon, Colorado.

Texas Pipeline Company

Illustration at left shows tractor with extended boom lowering gas pipe into 6-foot ditch. Soggy, caving ground made services of tractors essential.

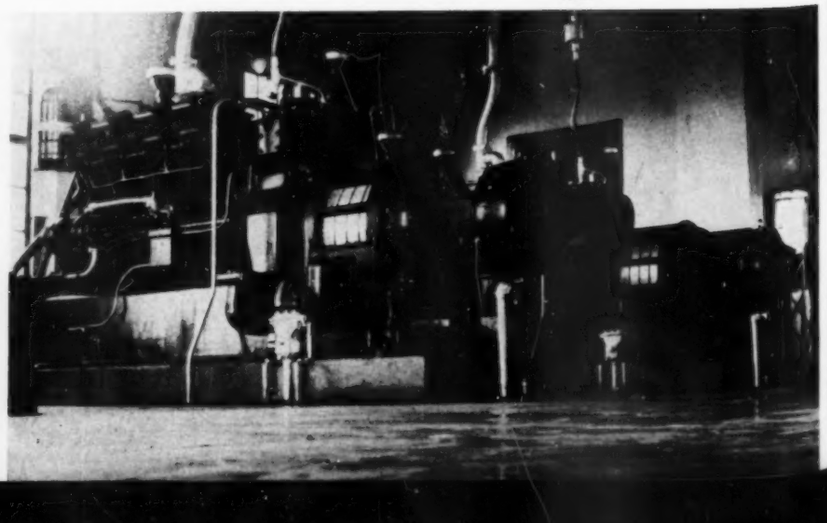
DIESELS ON TWO CONTINENTS



Bogota Radio Powered by Diesel

Left, Four-tower, bi-directional antenna at Bogota, Colombia used both for radio-telephone and telegraph operations by the All American Cable and Radio Power Station.

Below, Two Caterpillar Diesel-electric sets which supply power for Bogota radio. These 100 kva, 80 kw. units keep Colombia's capital in touch with the rest of South America and the United States.



Two raft-mounted sand pumpers in operation near Ashville, N. C. Both are powered by General Motors Diesels.

Sand from French Broad River is discharged into bin fifty feet above river level where water is allowed to drain.

Sand Recovery with Diesel

ALONG the banks of the picturesque French Broad River in the vicinity of Asheville, N. C., there are tucked away a number of productive sand plants that supply much of the material required for the construction road work in that area.

Clyde Reed Jr. and the Ashville Sand Company are two successful owners of such equipment and operate their units side by side on the river just adjacent to Biltmore Forest. Both are pumping plants and employ essentially the same technique for raising the material from sand pockets in the river bed. Each have a General Motors Diesel engine mounted on a raft driving a 6 in. centrifugal pump easily. Clyde Reed's home-made raft floated by 55 gallon oil drums carries a 100 hp. 3-cylinder GM Diesel and a 6 in. Erie "D" sand pump. Most of the time he is pumping from depths of around 30 feet and discharges the sand and water mixture into a bin 50 feet above the water level of the river. Screens at the discharge end regulate material sizes and prevent any foreign matter that may have been sucked up by the pump from entering the bin. Excess water is carried back to the river by a drain trough. The raft of course is moved around as sand pockets are emptied which on occasion makes it necessary to use as much as 295 feet of discharge line. Standard practice, unless demands are unusually heavy, is to fill the bin once a day and then allow the sand to drain.

It takes only two hours and 15 minutes to pump in a full load of 130 yards. Pick up trucks drive right underneath the structure and are loaded by chutes. Mr. Reed testifies as to the economy of the operation with the statement that his fuel cost is less than one cent for each 2 yards of sand produced.

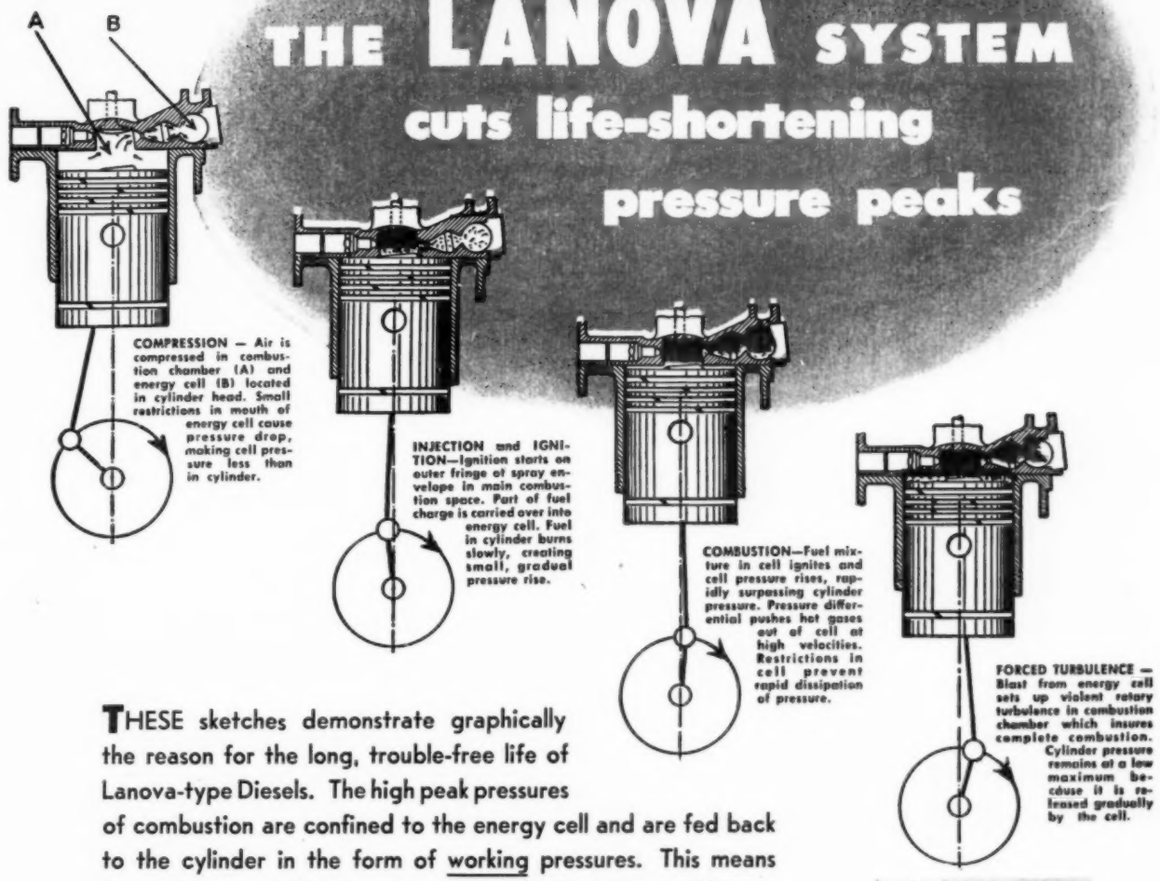
The Ashville Sand Company employs the same procedure with a 4-cylinder GM Diesel and a 6 in. Erie "HD" pump.

Two Unique Applications

Portable Unit Threshes Grain

EVERY fall at harvesting time Fred Brown of Avoca, Michigan takes out his truck mounted power unit and starts around the countryside to help the farmers of southeastern Michigan with their grain thrashing. Last winter after the season was over Fred got to looking over the record of his production and decided that he should be doing a little better. The old engine carried on the back of the truck just wasn't putting out as much as he would like to see. Fred combed the market and settled on a brand new General Motors 4-cylinder Diesel engine. This season it's been a different story for the Diesel is beatin' up the wheat in record time. As a matter of fact the Brown enterprise has exactly doubled its production rate. 5550 bushels in two days is the record so far. Fred doesn't confine his operations to thrashing however. His Diesel is flexible enough to saw wood, pump water, or handle any kind of a job where power is required.

How THE LANOVA SYSTEM cuts life-shortening pressure peaks



THESE sketches demonstrate graphically the reason for the long, trouble-free life of Lanova-type Diesels. The high peak pressures of combustion are confined to the energy cell and are fed back to the cylinder in the form of working pressures. This means lower maximum cylinder pressures and the elimination of heavy, life-shortening hammer blows that pound the bearings, slam down on piston rings, and cause engine fatalities.

The low pressures of the Lanova system make possible smaller, lighter Diesels per unit horsepower—Diesels that give smooth, dependable power with low maintenance costs and long life.

Further information about the Lanova Combustion System will be sent on request. WRITE TODAY. Address Dept. P.

LANOVA CORPORATION

38-15 30th STREET LONG ISLAND CITY 1, N. Y.

Check these other Lanova advantages:

- V Lower operating costs
- V High combustion efficiencies
- V Cleaner exhaust
- V Easier cold starting
- V Lighter construction
- V Simplicity and freedom from operational difficulties

The Lanova Combustion System is found only in Diesel engines manufactured by Lanova licensees.

THE HEART OF THE DIESEL

LANOVA *makes Diesels purr*

SUPERVISING & OPERATING ENGINEERS' SECTION

Conducted by R. L. GREGORY*

"Unit installation and its effect on Daily Operating Problems" Part 8.

WITH the completion of part 7, in last month's issue, we had about completed the assembly of the major items of the engine proper. The next step for discussion should be the generator, exciter and exciter drive, but since in this particular instance the writer is following the progress of erection in the chronological order, and there was a delay in the receipt of this equipment, due to circumstances beyond the vendor's control, we will turn to the erection of the exhaust and intake piping. Whenever one is confronted with the erection of a unit in a building already constructed, he will find himself faced with various problems which arise due to existing equipment and the building layout itself. These problems arose on the installation of the unit under discussion, when it came to the matter of the exhaust and air intake piping arrangement.

Figure 1 shows the generator end of the unit, and close observance shows the entrance to the plant office and washroom, along with the first gallery and the hatchway through the floor of the second gallery. The first gallery is used primarily as a stock room for spare parts, maintenance tools and equipment.

The air intake silencers, filter rooms and the exhaust snubbers for the units are beyond the wall in the background. When the original layout for the next unit was drawn up, the plan called for extending the air piping and the exhaust line directly out from the air and exhaust headers, over the first gallery floor, out through the wall and into the silencer and exhaust snubber. However this arrangement, while it could have been made, had three definite disadvantages.

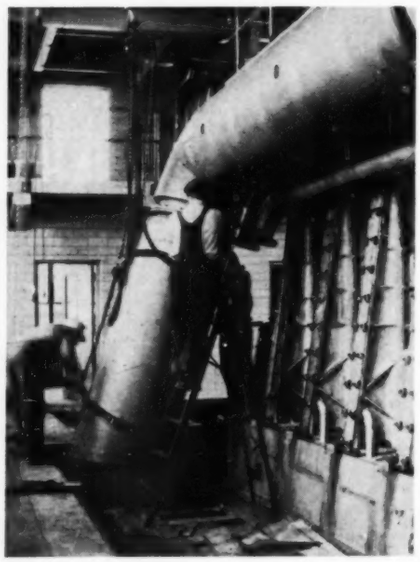
First it would make an unsightly arrangement and would intefere with the stock room arrangement by passing these pipes over the first gallery floor. Secondly, if the exhaust piping were so installed, it would block off the hatchway used in taking material from the first to the second gallery. Third, if these pipes were so installed, they would pass right over the generator and outboard bearing, making it very difficult to service this part of the equipment.

---

* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*

After studying various suggestions as to how to locate and install this piping it was finally decided to install it beneath the engine room floor. This would eliminate the obstacles presented in the original layout, and while there were a couple of drawbacks to this arrangement, such as headroom between the unloading platform, and the exhaust piping, the proximity

Fig. 1.



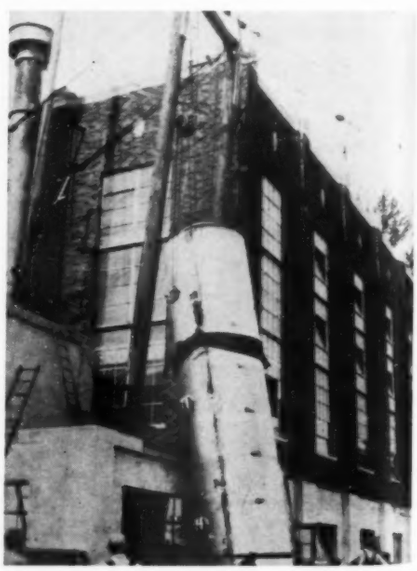
of the exhaust piping to other piping already installed on the first unit, and the fact that the air intake piping would have to be placed lengthwise through the foundation and be attached to the air header at the opposite end of the unit, still it seemed to be the logical arrangement to follow.

In order to better understand the whys and wherefores of this arrangement, let me state that the air for this unit is supplied by a large single stage blower, driven by a 300 hp. synchronous motor. This air is taken through an air intake pipe, into a filter room, passes through a set of rotary screens into another compartment, from where it is taken by the suction pipe from the blower.

There was not sufficient space in the building proper to house the new unit, separate blower, eight large starting air bottles and the air compressor which supplied the starting air, without tearing out the office and washroom, and locating them somewhere else, and since the partitions are all made of glazed tile, this would have been rather a costly item. It was therefore decided to build a blower room and filter house at the end of the building, reinforce the roof and mount the exhaust snubber and filter room addition on this roof. This blower room could be made large enough to house the starting air bottles and air compressor, which would also help eliminate the attendent noise of the blower and compressor in the main operating room.

Figure 2 shows the blower room and the method used in hoisting the exhaust silencer up to its base on the blower room roof. Referring again to Figure 1, it shows workmen installing the down section of the exhaust piping from the exhaust header. This exhaust snubber is equipped with two sets of heating coils, which are also interconnected with the soft water circulating system. These heating coils are so arranged that they furnish hot water to a heating coil in the service tank for heating the heating the fuel oil, and in addition to this supply hot water to an auxiliary fuel oil heater connected in series with the coils in the service tank and controlled by a Fulton Sylphon regulating valve, which automatically opens at a predetermined low temperature.

Fig. 2.



"We have changed lubricating oil only ONCE during the past FIVE YEARS"

Office of
TRUSTEES OF PUBLIC AFFAIRS
L. F. WERTZ Clerk and Supt.
TOWN HALL
PHONE 139
Lebanon, Ohio

April 28, 1946

Wm. W. Nugent & Co., Inc.
410-412 N. Hermitage Avenue
Chicago 22, Illinois

Attention: F. L. Townsend

Gentlemen:

Replying to yours of April 13th, advise that we are using your Nugent lubricating oil filters, and that we change the cotton waste cartridges once every month. We follow this practice without variation, and find that by so doing, the oil is kept in A-1 condition, as shown by periodical analysis. As you were informed by the Cooper Bessemer Corporation, we have changed the lubricating oil on these engines once during the past five years.

We do not use a cheap lubricating oil. In fact, on the bids received, we took the highest priced.

Trusting this answers your inquiry, we are,

Very truly yours,

TRUSTEES OF PUBLIC AFFAIRS
By
L. F. Wertz, Supt. & Clerk

LFW:DH

. . . thanks to the efficiency of NUGENT FILTERS!

The letter reproduced above is a tribute to the ability of Nugent Filters to keep lubricating oil *really* clean and serviceable . . . to the extent that it was necessary to change oil only once in five years.

Power for this municipal installation at Lebanon, Ohio, is furnished by two 1000 H.P. Cooper-Bessemer Diesels, each of which is equipped with a Nugent Absorbent Type Filter (indicated by arrow, above, and close-up at right). This filter, only *one* in the complete Nugent line, contains four replaceable type cartridges for quick, easy cleaning and renewal.

It is interesting to note that this installation follows a highly efficient formula for achieving continuous, dependable Diesel performance . . . by using good oil, high quality filters, and by changing filter cartridges as often as necessary . . . thus assuring clean lube oil at all times, resulting in longer, trouble-free engine life.

Let Nugent Filter Specialists help solve your fuel and lube oil filtration problems. Write for complete details.

Wm. W. Nugent & Co., Inc. Mfrs.

Oil Filters, Oiling and Filtering Systems, Telescopic Oilers, Oiling Devices, Sight Feed Valves, Flow Indicators, Compression Union Fittings, Oil Pumps, Etc.

415 N. Hermitage Ave. Established 1897 Chicago, U. S. A.

More Powerful Locomotives

. . . . *Continued from page 67* . . . .

should be on drivers because idler axles contribute nothing towards pulling power. It has been demonstrated that swivel trucks with swing bolsters are suitable for high speed service. At present there is some justification in some designs in not having all the weight on drivers as, for example, the case where a certain engine is to be utilized, and train heating equipment is to be applied to the locomotive. With these stipulations it is necessary to have a certain number of axles in order to obtain a reasonable axle loading. With existing designs, it is not necessary to have all of the weight on drivers to utilize the full engine horsepower in the operating speed range.

It is impossible to predict at what rate or how far the locomotive builder can go in increasing the horsepower-weight ratio, but it is expected that gradual improvements will be made from time to time. Such improvements will probably be brought about by the following:

(1) Lighter weight, higher speed power plants, by the use of higher bmep's.

(2) Greater amounts of supercharging or using a "hot gas" turbine in conjunction with Diesel engines.

(3) The gas turbine shows promise of providing a lighter-weight power-plant than the internal-combustion engine now in use.

(4) Further improvements in transmission equipment may be expected which will decrease the weight per horsepower.

(5) Alloy steel and aluminum will undoubtedly come into greater use permitting lighter mechanical structures.

(6) As the equipment required becomes smaller and lighter in physical dimensions a more compact arrangement of apparatus can be made to shorten and further reduce the locomotive weight.

The Diesel locomotive first proved its worth for low-speed switching service. In recent years it has been improved to the point where it has made a good freight and passenger locomotive and it is expected that in the years to come further weight reductions can be made to make it even more economical for high speed service than it is today.

ENGINEERING SOCIETIES MEETINGS SCHEDULED

A.S.M.E. 1947 Meetings

Annual Meeting	Atlantic City	December 1-5

S.A.E. National Meetings

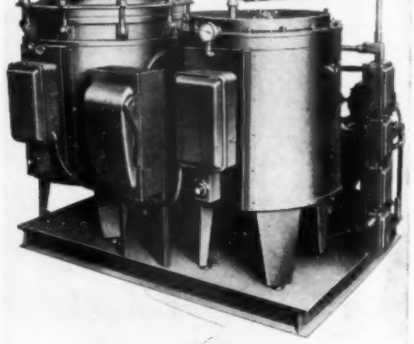
Air Transport Engineering	Kansas City	December 1-3
Annual Meeting and Engineering Display	Detroit	January 12-16

Oil Conditioner Developed By Hoffman Corporation

THE U. S. Hoffman Machinery Corporation, filtration Division recently announced the Hoffman Oil Conditioner. This equipment is a combination of a Hoffman vaporizer and a cartridge filter, mounted on a common base and arranged to afford operation of the filter independently or together.

The Hoffman cartridge filter, designed for the removal from oil of insoluble contamination, is offered in two types—One uses 11 x 18-inch cartridges, and may be had in sizes ranging up to 8-cartridge units. The other type uses 7 x 18-inch cartridges in multiples of 1, 2, 4, 7, 9, 14, and 18.

The 11 x 18-inch cartridges, of either repackable or throwaway types, utilize fullers earth or bauxite for removal of soluble or solid contaminants; or, they may be packed with cellulose or waste if insoluble removal only is required. The 7 x 18-inch cartridges are available only in the throwaway cellulose type.



New Hoffman Oil Conditioner

Removal from oils of elements not affected by the cartridge filter is accomplished by the Hoffman vaporizer. This unit is a specially-designed cylindrical tank constructed to operate continuously under 26 to 27 inches of vacuum. It contains a tier of removable metal trays which provide maximum surface exposure. Oil is introduced by a positive displacement inlet pump and a vane-type vacuum pump. It is then pumped through a preheater and a distributor head into the electrically-heated and thermostatically controlled vacuum chamber. Here it flows by gravity in a thin film over the trays, where the action of the heat causes the rapid evaporation of soluble impurities.

Information of cartridge filters and vaporizers is available from the Hoffman Corporation, 219 Lamson St., Syracuse 6, N. Y.

Smoke Control Program

. . . . *Continued from page 51* . . . .

ernor beyond the limits necessary to cut off the fuel supply and you get more smoke. The same result is produced by the vicious practice of breaking off the fuel-pump stop. When the throttle is pushed beyond the stop, the thrust collar, instead of the stop, takes the pressure of the driver's foot on the throttle. (Gus Martin prevents this by welding the stop so that it can't be broken off without putting the whole fuel-pump out of commission.)

Some conditions that produce smoke may not be due to faulty operation of the engine and out of the power of the driver to correct.

Injectors out of time will cause smoke. When they are timed correctly, injection of the fuel into the cylinder begins at 49.5° before top dead center, and ends 19° past top dead center. If the fuel is injected too early, it begins to burn before the compression stroke is completed. This addition of part of the pressure of burning to the pressure of compression not only wastes power, but may result in pressures beyond the limits of the engine's design.

If the fuel is injected too late, its combustion may not be completed in the cylinder, but continues in the manifold. This after-burning not only does no work, but results in smoke and flame, and excessive exhaust temperatures.

A properly operated engine may smoke if there is excessive back pressure in the exhaust pipe or muffler. The back pressure should not exceed .75 pounds in the Standard models and 1.60 pounds in the Supercharged models.

High back pressure may result from obstructions in the exhaust pipe or muffler or from any change in the exhaust system, as in repairing or rebuilding, that lowers its cross-sectional area and subsequent carrying capacity. Such pressure prevents the complete scavenging of the exhaust gases from the cylinder.

Clogging of the air cleaner will also result in smoke. On the intake stroke, air is forced through the cleaner, and into the cylinder by the pressure of the surrounding atmosphere. A clogged cleaner will interfere with the free flow of air, and may lower the pressure in the intake manifold. The effect will be in part the same as that of thin air at high altitude or high temperature, and if the driver tries to compensate for the loss of power by opening the throttle instead of changing gears, the engine will smoke.

Clark Brothers Company Announces Organization Changes in New York Office

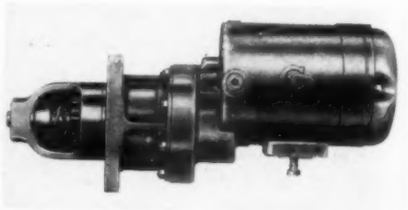
CLARK Bros. Co., Inc., recently announced several changes in its New York office. R. R. McCartney, New York District Manager, has assumed the duties of Export Manager following the resignation of T. F. Hudgins who will enter business for himself in Dallas, Texas. Robert Spears has been assigned to technical service in the New York office.

Demco Appoints Manager of Field Engineering

RECENTLY announced was the appointment of Harry O. Hill as manager of field engineering and sales for Diesel Engineering and Manufacturing Company. Mr. Hill entered the Diesel field with the Hill Diesel Engine Company in 1923 and since then he has been continuously engaged in the fuel injection end of the business, having worked with many of the engine manufacturers on fuel injection.

Air Operated Starter for Diesels

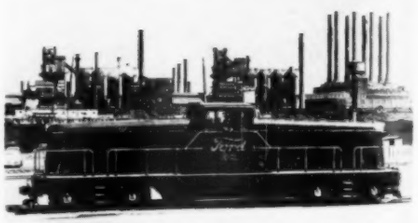
A NEW Air Starter for Diesel engines has been announced by the Chicago Pneumatic Tool Company. The starter is a 7 hp. air motor with a Bendix starting drive. A unit 18 inches long and 5½ inches in diameter, it is mounted on any Diesel by means of an SAE #2 flange.



New air starter for Diesels

The air starter easily handles Diesels up to 600 cubic inch displacement. Its initial cost is reasonable, and its upkeep, due to its simple mechanics, is negligible. Further information concerning this new product may be obtained by writing the Chicago Pneumatic Tool Company, 6 East 44th St., New York 17, New York.

GE Diesel-Electric Locomotives At Ford Plant



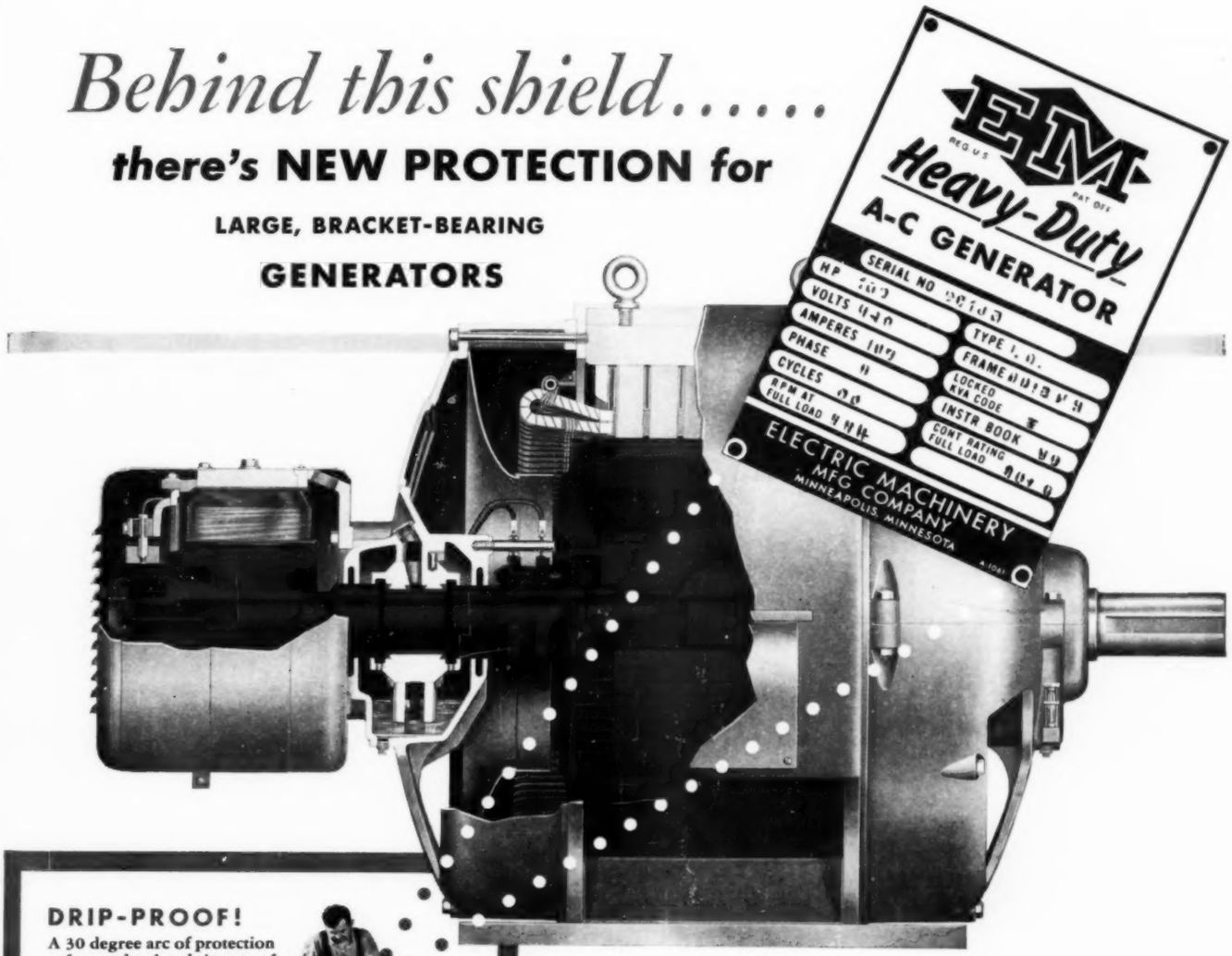
GE 1000 hp. Diesel electric locomotive seen at River Rouge plant.

THE country's largest industrial manufacturing railroad, the 130-mile network of the Ford Motor Company's Rouge plant at Dearborn, Mich., now is operating with 17 G-E Diesel electric locomotives. The railroad system assures a rapid and highly co-ordinated flow of raw materials and finished products among the various buildings within the Rouge plant's 1200 acres. Outstanding in the system's motive power are eight specially built G-E 132 ton, 1000 hp. Diesel electrics, designed and finished to Ford specifications. The other G-E locomotives are three 50 ton, 300 hp. unit; an 80 ton, 500 hp. unit; a 110 ton, 600 hp. unit, and four 100 ton, 660 hp. units. These latter four units are part of the American Locomotive-General Electric locomotive line.

Behind this shield.....

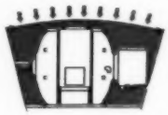
there's NEW PROTECTION *for*

LARGE, BRACKET-BEARING GENERATORS



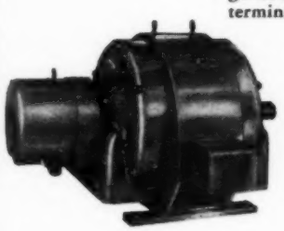
DRIP-PROOF!

A 30 degree arc of protection safeguards the drip-proof model from falling liquids or particles. The smooth, rounded frame construction invites easy cleaning.



SPLASH PROOF!

Defense against splashing or flying particles is provided in a 200 degree arc of protection in the splash-proof type generator. Note the roomy terminal box.



●The E-M monogram—symbol of dependable engineering and advanced design backed by years of specialized experience—now stands for *extra protection.* On large, bracket-bearing generators, E-M's newest insignia emblazons protective construction that permits operation under extremely adverse conditions. Either drip-proof or splash-proof protection is available in the new generators, together with these E-M features:

1. Strong steel frame. 2. Triple-dipped, extra-tough stator coils. 3. Cemented field coils. 4. High-capacity, braze welded cage winding. 5. Large hand hole for access to brushes. 6. Leak-proof, cool-running sleeve bearing. (Ball-bearings also available.) 7. Removable exciter enclosure for easy access to brushes.

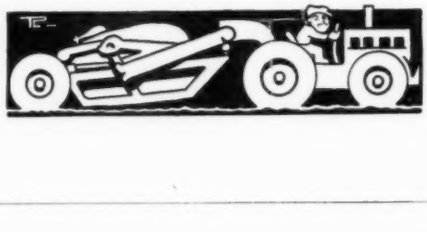
E-M provides all these advantages with a new, streamlined unit that makes any generator set more reliable. With this added protection, more jobs can now utilize the superior engineering and skilled craftsmanship gained in E-M's 50 years of specializing in engine-driven generators.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

A2052

Motor Boat Show Opens January 9th

ALTHOUGH the 38th National Motor Boat Show will not begin its traditional 8-day run at Grand Central Palace, New York, until January 9th, Ira Hand, Secretary of the National Association of Engine and Boat Manufacturers, recently announced that the Show Committee is already hard pressed to find space for all hopeful exhibitors. Some 80 firms wish to be represented at the Show for the first time. As in the past the main floor will be occupied by the larger exhibits which will include the larger marine Diesels. The lighter Diesels along with smaller boats will occupy the mezzanine.



St. Louis Railway Supply Co. Formed

A NEW company has entered the railway supply field, the St. Louis Railway Supply Co., 2114 North Second Street, St. Louis 6, Missouri. Principals of this new enterprise are Frank E. Ross Jr. and Robert M. Close.

Frank E. Ross Jr.

Mr. Ross was recently associated with Fairbanks, Morse & Co. as sales engineer in charge of Diesel Locomotive sales, with headquarters in St. Louis. He joined F-M July 1, 1945. Mr. Ross received his electrical engineering education at University College, Washington University, St. Louis, and has followed an unbroken railroad career having served as apprentice electrician, Diesel and steam locomotive repair shop foreman, and Diesel Mechanical Officer on Staff of U. S. Railway Mission to Mexico.

Robert M. Close

Mr. Close, also educated at Washington Uni-

versity, was formerly commercial representative for Southwestern Bell Telephone Co., and later associated with Aquart Manufacturing Co. as salesman, partner, and controlling stockholder.

The new company formed by these two men will handle a widely diversified line of railway supplies including Farr air filters and Wix fuel and lube filters.

Blackhawk Announces Torque Indicators

SIX torque indicator models are listed in a new catalog bulletin issued by Blackhawk Mfg. Co.

Torque indicators (tension wrenches) are, in effect, socket wrench handles which measure the amount of pull exerted by the workman. They enable uniform tension on a series of bolts, to prevent distortion of the assembly. Blackhawk Torque indicators include a model having fine readings within a 50 ft.-lb. range. The largest model has a capacity of 1000 ft.-lbs.

The new bulletin, No. 46T (along with a 36-page socket wrench catalog), can be had by writing Blackhawk Mfg. Co., Milwaukee 1, Wis.

Universal Tachometer Head By Metron

Wide range tachometer head

A VERSATILE tachometer head is now available for all speed measurements between 100 and 10,000 rpm. Reliability and freedom from maintenance have been stressed in the design and construction. It contains only one rotating part which is mounted in permanently lubricated ball bearings.

A sturdy case of aluminum provides a rugged, light weight unit (14 ounces). Their small size permits easy mounting in cramped quarters. Dimensions are 2-3/16 in. x 1-15/16 in. x 5 in. Operating torque is approximately 1/30 ounce-inches. Standard SAE marine fittings for this head are available for use directly on gasoline and Diesel engines.

For further information write Metron Instrument Co., Denver 9, Colorado.

WHY Clean Intake Filters More Than Once A Year?

YOU DON'T NEED TO WITH STAYNEW!!!

"When I first started as a maintenance engineer . . . more years ago than I like to admit . . . I found out for what long periods Staynew Intake Filters operate before cleaning is necessary.

"What's more, I found out that the high initial efficiency of Staynew Filters actually increases with use, because dust accumulates on the fins and forms a filter-aid of the very material being handled!"

Efficient Operation Up To 20 Months Reported By STAYNEW Users

TEXAS OIL OPERATOR:
"Conditions severe, but Staynew filters require cleaning only once every 15 months."

PENNSYLVANIA STEEL MILL:
"Staynew filters cleaned every 12 months."

MID-WEST CONCERN:
"Staynews throughout plant —average cleaning period, 18 months."

WEST COAST MANUFACTURER:
"Staynew intake filters operating at maximum efficiency after 20 months continuous service."


Model KE


Model C


Model D


Model DS


Model IDR


Models F and G

And When Staynews Do Require Cleaning... IT'S A CINCH!

These Staynew Intake Filters are dry type. There are no moving parts, no liquids, no reservoirs to be re-charged. They can be cleaned in just a few minutes by either vacuum or washing.

6 Models From 5 to 16,000 CFM

All Feature Original Radial Fin Design, Providing Maximum Filtering Area in Smallest Possible Space.

Model KE For small capacity use where weather housing is not required.
Model C Original *Protectomotor* design. For small capacity use where weather housing is required.
Model D The standard for heavy duty intake service on large engines and compressors.
Model DS Similar to Model D with the addition of a silencing chamber.
Model IDR Has the convenience of ground level installation plus the advantage of high level air intake.
Models F and G Low cost units for medium intake sizes.

COMPLETE DETAILS ON REQUEST

DOLLINGER CORPORATION
12 CENTRE PK., ROCHESTER 3, N. Y.

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

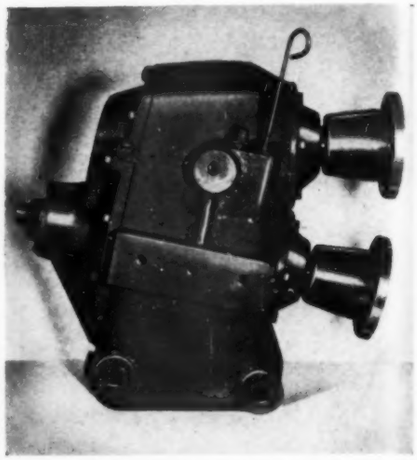
Representatives in Principal Cities

Avondale Marine Ways Awarded Additional Contract for 40′ Launches

THE Creole Petroleum Corporation, subsidiary of Standard Oil Company of New Jersey, has awarded a contract to Avondale Marine Ways, Inc., of the New Orleans District for the construction of fifteen additional 40 foot launches.

Avondale recently completed the construction of seventeen similar launches for Creole. They are for use in the oil fields of Lake Maricaibo, off the coast of Venezuela in South America. These launches have a speed of 22 miles per hour and are powered by twin screws connected to two General Motors Diesel engines. They have a seating capacity of 30 men. The hull is of all-steel-welded-construction and the upper portion is of aluminum, for purposes of lightness. This launch was designed by Philip L. Rhodes, well known Naval Architect of New York City.

Vee Drive Marine Gear



Western Marine Vee Drive

A NEW marine type Vee Drive has been announced by Western Gear Works. Known as the Western Marine Vee Drive this latest addition to the line of Pacific-Western marine products is the result of several years of research, design and testing.

The Western Marine Vee Drive has a twelve degree shaft angle and is available in five ratios, 1:1, 1½:1, 2:1, 2½:1 and 3:1. It is already in use aboard many west coast boats. It permits the engine to be mounted in the stern of the boat with the Vee Drive itself located under the deck of the salon.

The spiral bevel gears used in this Pacific-Western unit are precision cut, case hardened, lapped and checked for sound level. The water jacketed housing of the Western Marine Vee Drive is of cast iron and designed for adaptation to a small base, taking up very little room in the boat.

Information and catalogs on the Western Marine Vee Drive, or other marine equipment, can be obtained by writing Western Gear Works, P. O. Box 192, Lynwood, California, 417 9th Avenue South, Seattle 4, Washington or Pacific Gear & Tool Works, 1035 Folsom Street, San Francisco 3, California.

Electric Equipment Company Opens New York Office

THE establishment of a New York sales office by the Electric Equipment Company of Rochester, New York, was announced recently by I. S. Norry, President of the company. The new office will be located at 224 E. 38th St. The company carries a complete line of new and rebuilt electric motors, generators and transformers.

Enterprise Elects New President

William E. Butts

RECENTLY announced, is the election of William E. Butts, a director for the past several years, to the Presidency of Enterprise Engine and Foundry Co., to succeed Charles Hoehn, Sr., who retires from 30 years direction of the Company's activities in the Diesel Engine, Oil Burner and Food Processing Machinery fields. In addition to his responsibilities as head of Enterprise's operations, Mr. Butts will retain his present capacity as Vice-President of General Metals Corporation, which position he has held for over 10 years. Widely known throughout Industrial circles, Mr. Butts has been recognized for his many contributions to manufacturing industries. Mr. Hoehn, Sr., will remain on the board of directors and serve in a special consulting capacity.

Sheppard Appoints Dealer In Virginia

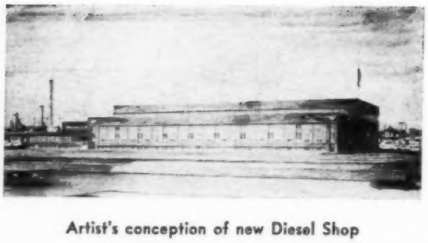
THE R. H. Sheppard Company has appointed Diesel Sales & Service of Virginia, 224 Yarmouth Street, Norfolk, Virginia, as their distributor for the complete line of Sheppard Diesel power units, marine engines, and generating sets in the eastern half of Virginia.

Diesel Sales & Service of Virginia is owned and operated by Dan Gibson, who is well known along the East Coast by Diesel operators. Mr. Gibson has spent the past twelve years with Cummins Diesel in sales and service, as well as having served as a mechanical technician with the Navy during the war.

A complete line of engines and parts will be carried in stock, and there will be servicemen available at all times.

Diesel Repair Shop for Chicago Northwestern

CONTRACTS for the construction of what will be the most modern Diesel locomotive servicing and repair shop in the country have been awarded to S. N. Nielsen Company of Chicago by the Chicago and North Western Railway Company, it was announced recently by R. L. Williams, president of the company.



Artist's conception of new Diesel Shop

The new Diesel locomotive servicing and repair plant will have an overall length of 404 feet. The cost of the new plant, including revision of certain trackage and existing facilities, will be approximately $1,800,000.

The main building will contain five tracks, three of which will run through the plant and will be used for general servicing. Heavy overhaul work will be done on a fourth track while the fifth will be a truck release track. A drop pit will run the full width of the main shop serving all five tracks. Overhead will be a traveling crane with a 75-foot span operating the full 250-foot length of the building in the high bay.

The new servicing plant, expected to be completed by the fall of 1948, is designed to handle heavy repairs of Diesel locomotives for the entire railway system.

Globe-Union in Expansion Announces Two Plants

C. O. WANVIG, president of Globe-Union, Inc., recently announced the acquisition of two new factories. This enlarges the firm's national organization to 10 plants in strategic points throughout the country. Other Globe-Union factories now in operation besides Milwaukee are at Atlanta, Boston, Cincinnati, Dallas, Los Angeles, Memphis and Philadelphia.

"In order to take care of the growing demand for Globe batteries, additional plant capacity has been acquired at Mineral Ridge, Ohio and Oregon City, Oregon," Wanvig said.

"One new factory, having a 32,000 square foot area, is located about 10 miles from Youngstown and will serve the productive region of eastern Ohio, western Pennsylvania and West Virginia. The other factory at Oregon City, which is 10 miles south of Portland, has an area of 26,000 square feet and will serve Oregon, Washington and the adjoining mountain states."

It is expected that the production of each factory will reach more than 1,000 batteries daily, starting early in 1948. Additional employment for operation of these two units will be about 200 men. The Globe-Union line includes automotive batteries for passenger cars and trucks, also heavy duty batteries for Diesel starting, farm lighting and industrial applications.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now. Thoroughly revised — more complete — indispensable. Convenient order coupon on Page 103 this issue. Mail it today.

Diesels In Underground Mining

. . . . *Continued from page 57* . . . .

in England and continental Europe. The considerable numbers of this type of locomotive in service in underground coal and noncoal mines (gassy as well as nongassy) of Europe prove that they are successful in this application, and studies by the Bureau of Mines and a limited amount of actual experience in operation of Diesel locomotives in underground workings in American mines indicates that suitably designed and operated Diesel locomotives can and should be used in the mines of the United States.

Diesel equipment used underground must be kept in good repair at all times; proper maintenance is a "must" if trouble is to be avoided. The safety devices on Diesel locomotives such as the exhaust-gas conditioner and flame arrester (especially in coal mines) must be kept in good working order and must be used at all times when Diesel equipment is operated underground; the ventilating air currents must be strong enough to keep the amount of toxic gases in the general mine air below the maximum limits regarded as safe for a working environment. If these precautions are observed, the Diesel mine locomotive can be used with a reasonable degree of safety and unquestionably with much greater safety than trolley locomotives; and there is good reason to believe that ultimate haulage costs with Diesels will be lower and efficiency higher than with the trolley system in use now.

Fairbanks-Morse Personnel Changes

FAIRBANKS, Morse & Co. announce the following changes in its sales organization.

J. C. Elmburg, Manager of the company's Boston Branch House, has been transferred to the company's Atlanta, Georgia, Branch House to assume the position of Manager of that area. He replaces G. N. Van Epps who recently resigned.

V. O. Harkness, who has been Manager of the Diesel Division at Chicago Headquarters, has been appointed Manager of the Boston Branch and T. M. Robie of Chicago has been appointed to the position of Manager of the General Diesel Sales Division.

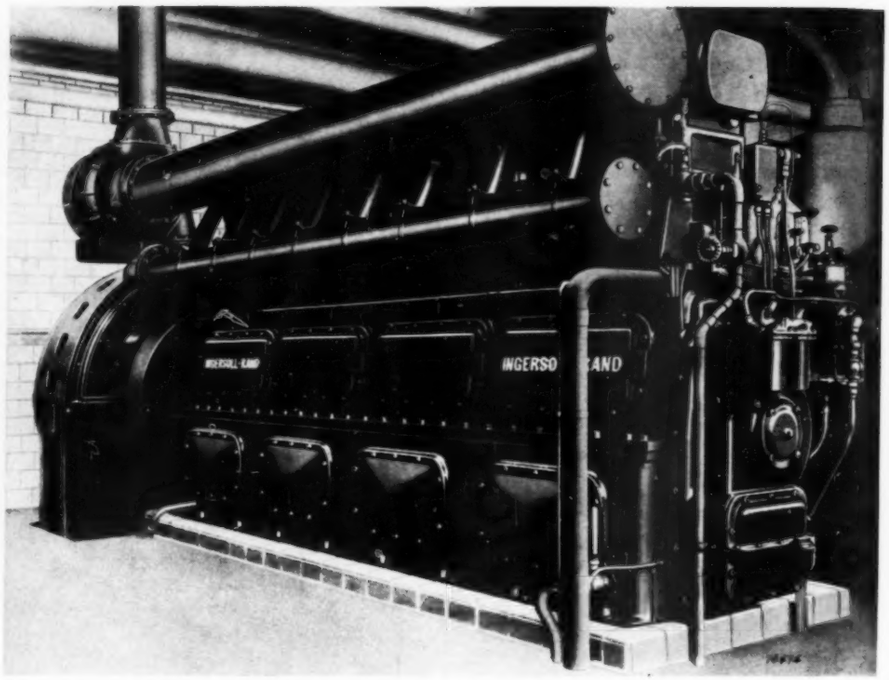
John E. True goes to the Cincinnati Branch to replace A. R. Stacy who recently resigned Mr. True has been associated with the Chicago office since 1932.

TYPE "SS" TURBOCHARGED DIESEL ENGINES

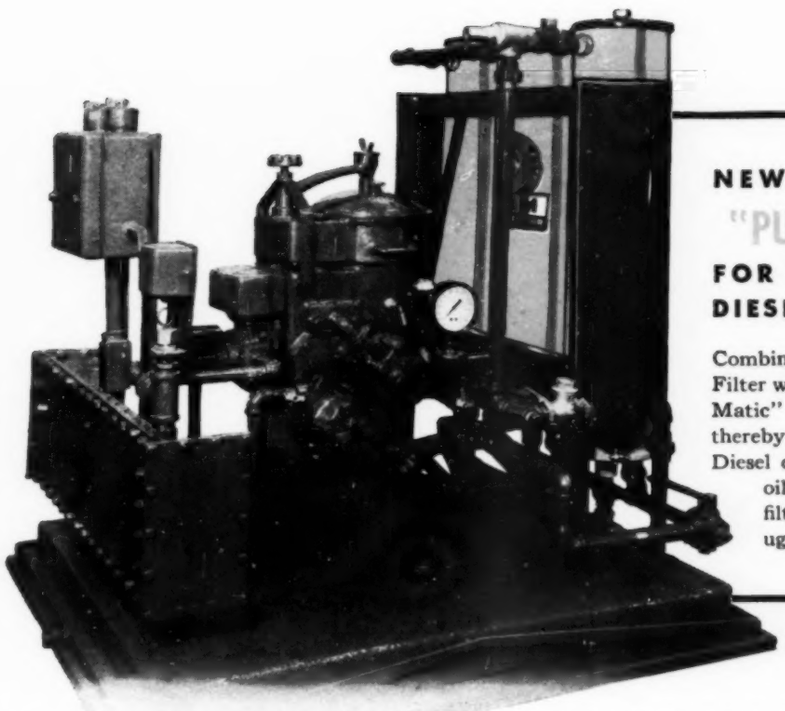
INGERSOLL-RAND Company has recently published a bulletin describing its new Type "SS" turbocharged Diesel engines. The new engine develops 50% more horsepower than an unsupercharged Type "S" engine having an equivalent number of cylinders, yet there is no increase in overall size and less than 15% increase in weight.

The Buchi system of turbocharging used in the engine consists of a compact exhaust driven, turboblower that delivers air under pressure to the engine cylinders. The pressurized air scavenges hot exhaust gases from the cylinders, leaving less heat to be absorbed by the cooling water. Then it replaces the exhaust gas with a fresh charge of high density air which results in higher output per cylinder as compared to the unsupercharged engine. Fuel economy for this new engine is .38 lbs./bhp./hr. when operating over one half load.

For additional information and bulletin write Ingersoll-Rand, 11 Broadway, New York 4, N. Y.



Ingersoll-Rand Type "SS" 8 cylinder, 900 hp. turbocharged Diesel.



NEW DE LAVAL
"PURI-FILTER"
FOR PURIFYING DIESEL LUBE OIL

Combines Fram Filcron Filter with De Laval "Uni-Matic" Oil Purifier . . . thereby enables large Diesel operators to purify oil by *both* positive filtration and centrifugal force.

FRAM FILTERS AND DE LAVAL EQUIPMENT DO A BETTER JOB

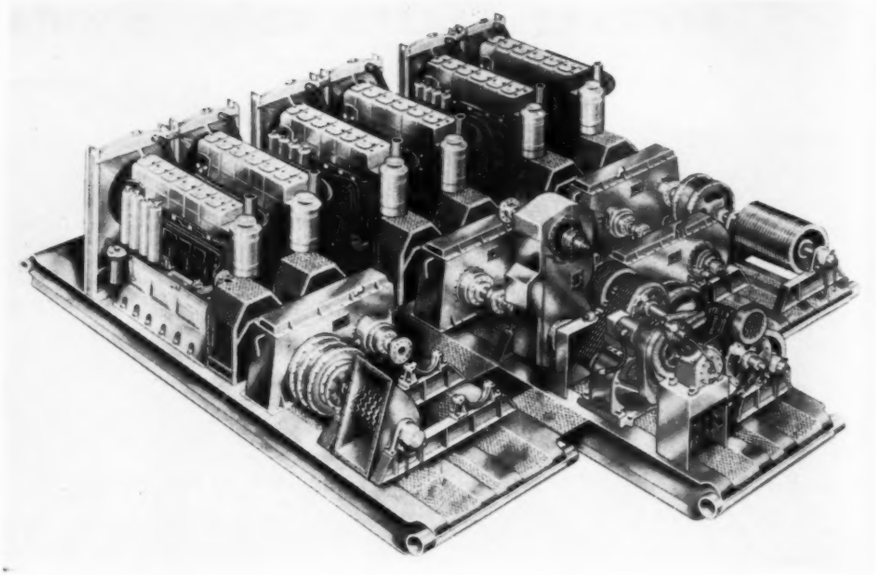
Fram Lube Oil Filters have been chosen to do another important job for Diesel operators. De Laval has combined the Fram Filcron Filter with their own "Uni-Matic" Oil Purifier to create the De Laval "Puri-Filter" . . . which keeps oil clean by centrifugal force *plus* micronic filtration. After the oil has been dried and cleaned by centrifugal force, the Fram Filcron Filter removes colloidal particles as small as one micron—.000039 of an inch. For Diesel filtering problems of any kind, Fram usually can help you find the answer. There's a Fram lube oil filter correctly engineered for practically any type of Diesel, gasoline or gas engine and a Fram *fuel* oil filter made in the correct size to service any type of Diesel engine you may have. Write Fram for filters and cartridges to test in your own laboratories . . . or in actual operation. Fram Corporation, Providence 16, R. I. *In Canada:* J. C. Adams Co., Ltd., Toronto, Ontario.

FRAM OIL & MOTOR CLEANER

Cleans the Oil that Cleans the Motor

New Multiple Engine Drive

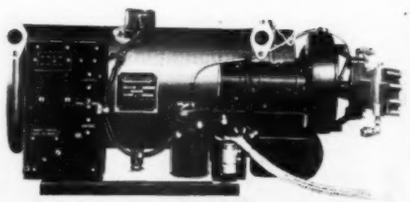
SIX 240 hp. Cummins Diesels drive a new type oil drilling ring which has been developed by the Mid-Continent Supply Company. The drive designed for drilling depths up to 20,000 feet consists of three skid-mounted units each with two Diesels mounted side by side. Each of these engines is equipped with a 18-inch Fawick air clutch and each pair drive a dual engine compound. Each compound has a jaw clutch on one of the shafts. To compound the power available from all the Diesels a swinging compound was devised which swings into an upright position when not in use thereby permitting easy transportation of the sections without the necessity of disconnecting chains or removing guards when separating the units. The operation of the power units is accomplished by air throttle controls at the driller's position. Power take-offs for drawworks and pumps are located outboard and can be driven by any combination of engines.



Six Cummins Diesels drive new oil field power unit.

The Cummins Diesels develop 1440 hp. at 900 rpm. and are arranged for easy servicing. Any engine can be taken off the line without interfering with the operation underway. Instrument panels are mounted on the drawworks side of each engine. Air cleaners have been mounted at the flywheel end of each engine for accessibility. Special narrow radiators for each engine give ample cooling water capacity. Extra heavy, four-runner skids are used. Skid extensions in front of the radiators are adequate for moving engines outward to provide space between the engine and the compound when hydraulic couplings are used.

Coolant Heater



Fluid heat coolant heater

THE Model 77 Coolant Heater, designed and manufactured by Anchor Post Products, Inc., develops 77,000 Btu. on about ¼ of a gallon fuel consumption per hour. Its functions are entirely independent of engine or vehicle operation.

Available in 12 or 24 volt models—burning gasoline or Diesel fuel—the heater when hooked into the engine coolant or vehicle's heating system will maintain engine temperature at efficient and economical operating levels and provide additional source of heat for passenger comfort. The Fluid Heat Coolant Heater gives bus operators, fleet operators and construction contractors a means of saving money in permitting outdoor storage of vehicles and machinery even during cold weather. The Fluid Heat Coolant Heater may be started a half to three-quarters of an hour before the outdoor stored vehicle or machinery is needed for actual service and through coolant system hook-up, bring the vehicle's engine temperature up to operating level.

The Fluid Heat Coolant Heater can be aquastatically set to maintain a constant 50° overnight temperature in the engine block and thereby inhibit the formation of cold weather sludge.

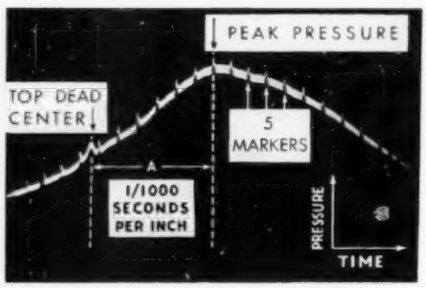
For further information write Fluid Heat Division Anchor Post Products, Inc., 6500 Eastern Ave., Baltimore 24, Maryland.

1948 Marine Tide Calendar

SOCONY-VACUUM Oil Company has published the 1948 edition of the marine tide calendar and distribution will be made to pleasure and commercial boat owners along the Atlantic seaboard by Mobilgas marine dealers and by the company's marine sales department, 26 Broadway, New York.

The calendar lists times of high and low tides, as well as times of sunrise and sunset, at Boston and New York, with reference tables for individual localities along the entire Eastern seaboard.

Syncro-Marker Pressuregraph Records Flame Propagation Rate



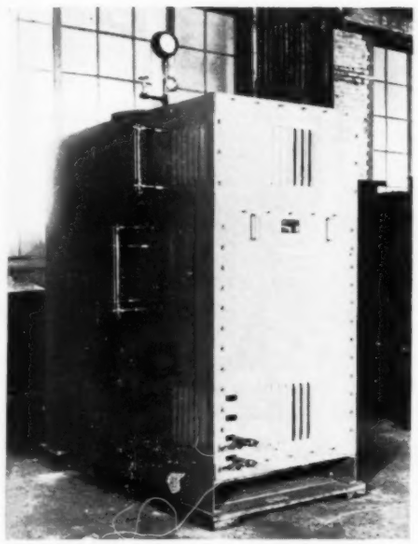
Typical pressure-time diagram as shown on Pressuregraph.

THE Syncro-Marker recently announced by Electro Products Laboratories, is an improved model of the well-known Pressuregraph used to obtain the substantially linear pressure-time curve indication of performance of engines, pumps and other apparatus and pipe lines subject to internal pressure variations, dynamic or static. The Syncro-Marker is a new electronic device which greatly broadens the field of applications. It makes possible accurate studies of the pressure actions and flame propagation of many types of engines, including Diesels, and the new jet engines. It permits the thorough studies of fuel efficiencies, displacement of moving parts, etc.

Complete information may be had by addressing the manufacturer, Electro Products Laboratories, 549 West Randolph St., Chicago 6, Illinois.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now. Thoroughly revised — more complete — indispensable. Convenient order coupon on Page 103 this issue. Mail it today.

New Waste Heat Boiler



Alco exhaust waste heat boiler

FULLY self-contained and very compact, an exhaust waste heat boiler of an entirely new design has been recently developed by American Locomotive Company, according to Hugh Corrough, director of the company's Alco Products Division.

Enclosed in an insulated steel cabinet only 6 feet, 6 inches long; 7 feet, 6 inches high, and 3 feet, 2 inches wide, the unit functions automatically on exhaust gases from a turbocharged Diesel engine, or it can be operated by household type oil burner. The waste heat boiler generates 500 pounds of steam per hour on the Diesel exhaust and considerably in excess of that figure when operating on the oil burner.

Seventeen of the new boilers are in service at pumping stations along the Great Lake Pipeline Company route, which stretches from Barnsdall, Oklahoma, via Kansas City to Grand Forks, N. D. In both cases, the waste heat boilers are functioning or will function on Alco turbocharged 12½ x 13T, 600-720 rpm. Diesel engines. However, the new boiler can operate on any turbocharged Diesel.

Exhaust gases of 600 to 800 degrees Fahrenheit coming from the Diesel engine run the unit as long as the engine functions. When the engine is shut down, the boiler burner is cut in by a few simple steps, so that there is almost no interruption in the boiler's operation, and no break at all in the heating service. When no heat is required, the boiler can be run dry, acting as a muffler to the Diesel engine.

Freedom Train On 33,000 Mile Tour

Alco-GE Diesel hauls Freedom Train

THIS is the American Heritage Foundation's Freedom Train which made its debut in Philadelphia recently with a precious cargo of more than a hundred historic documents. The famous train is pulled by a 2000 hp. Diesel-electric locomotive which was donated jointly by the American Locomotive Company and the General Electric Company. It will pull the train on a twelve-month nation-wide tour which will cover more than 33,000 miles on 54 different railroads. Three hundred cities in 48 states will be visited. Arrival of the Freedom Train in each community will climax a week-long civic program to rededicate the heritage of American freedom and democracy.

Gregory Regrets

H. L. GREGORY writing in the "Supervising and Operating Engineers' Section" in the November issue concerning his new Diesel at Hillsdale, Michigan stated that head clearance had been set at 11/16 inches. He wishes to inform readers that 5/16 inches is the correct dimension.

Minerva Curvimeter

THE Herman H. Sticht Co., Inc., has recently issued a new leaflet showing the new Minerva Curvimeter imported from Switzerland. This new Curvimeter measures distance accurately by running the instrument along the lines of a blue print or plan. Three scales are incorporated in the instrument, 1/8 in. equals 1 foot, 1/4 in. equals 1 foot, and 1/2 in. equals 1 foot.

Minerva curvimeter

The 1/4 in. scale registers up to 1200 feet. The 1/8 in. scale registers up to 2400 feet. The hands can be reset by push button. One feature of the instrument is that if a certain distance has been erroneously measured the mistake can be rectified by simply reversing along the line, in which case the hand on the dial moves backward. The contact wheel of this new instrument is mounted on two jewels which gives long wear and long service. Slow pencil figuring and mental calculating which is always subject to error is eliminated with the use of this new Minerva Curvimeter.

The Herman H. Sticht Co., Inc., will mail descriptive literature to anyone on request. Mention Bulletin No. 600, 27 Park Place, New York, N. Y.

Catalog Discusses Oil Filtration

PUROLATOR Products has completed preparation of a new catalog on oil filter applications for Diesel engines. This 16 page catalog is profusely illustrated. It contains scaled diagrams of the many types of oil filters made by Purolator for Diesel engine applications. The description page for each filter also includes a detailed specification chart giving all necessary technical information.

Of particular interest is the P Type or Micronic element. This is the element which embodies a process for impregnating selected cellulose with a resin which will withstand the effects of high pressures, varying temperatures and at the same time permit fine filtration.

This catalog will be mailed on request by Purolator Products, Inc., Newark 2, N. J.

WEST COAST DIESEL NEWS

By FRED M. BURT

PURCHASED by Senor Bustamonte, Sonora, Mexico, from Fairbanks-Morse, Los Angeles branch, were two 120 hp., one 150 hp. Diesels, to drive F-M Pomona 2500-3000 gpm. pumps, used for irrigation purposes.

THE eighth steel tuna clipper built by National Iron Works, San Diego, in past two years, the 106 ft. *Lucky Star*, for owner-manager Manuel Freitas, is powered with an Atlas 6 cyl., 550 hp. Atlas Imperial Diesel. Auxiliaries are Atlas 112 hp. Diesels, direct-connected to 94 kva. generators.

AMPHIBIAN Air Transport, Inc., Long Beach, is having Karl French, naval architect-marine engineer, design conversion of 110 ft. x 30 ft. x 8 ft. 4 in. Government surplus barge, into a floating airdrome, for their Santa Catalina terminus; to be powered with two 10 kw. Buda Diesel generating sets.

PRODUCTOS Lactos, S.A., Hermosillo, Sonora, Mexico, is installing a Fairbanks-Morse 300 hp. Diesel with 200 kw. generator and a 150 hp. engine, 100 kw. generator, for power in their dairy products plant.

A CATERPILLAR marine Diesel engine supplied by Thomas A. Short Co., San Francisco, powers a new addition to the Monterey fishing fleet, the 41 ft. otter trawler *Two Brothers*, built for partners Grillo and Pennisi.

PURCHASED by Columbia River Packers Associations, Inc., headed by Nick Bez, two surplus 328 ft. LST ships, being converted to refrigerated tuna carriers by Willamette Iron & Steel Co., Portland, Ore., are each powered with twin 870 hp. General Motors Diesels.

RECONVERTED from wartime uses at the Arques Shipyards, Sausalito, the 56 ft. albacore boat *Gloria H*, has been repowered with a 200 hp. Cummins Diesel engine, fitted with a 4:1 Twin Disc clutch and reduction gear, from Watson & Meehan, San Francisco, Cummins distributors, for owner Grant Allen.

ARTHUR DE FEVER, former naval architect at the Hodgson-Greene-Haldeman Shipbuilders, Long Beach, has joined Capt. A. C. Wilvers, independent marine surveyor, to form the firm of Wilvers and De Fever, San Pedro. De Fever established his reputation designing war craft and long-range fishing vessels, particularly Diesel-powered tuna clippers.

THE 115 ft. tuna clipper *South Coast*, built by Western Boatbuilding Co., Tacoma, for Dan Marks & Associates, is powered with a 400 hp. Atlas Imperial Diesel, with General Motors auxiliaries.

BUILT by Hawaiian Shipyards Div. of Hawaiian Tuna Packers, Ltd.; H. C. Hanson, Seattle architect, the 75 ft. steel tuna clipper *Amberjack*, is powered with twin 330 hp. General Motors Diesel units.

THE 86 ft. San Pedro purse seiner *American Boy*, has just received a new 90 hp., 6 cyl. Fairbanks-Morse Diesel auxiliary.

APACHE Railway, Arizona, has purchased two Fairbanks-Morse Diesel locomotives, each composed of two 2,000 hp. units, powered with F-M Model 10 cyl. opposed piston engines.

A NEW single cylinder stationary Diesel engine is now in production at Lorimer Diesel Engine Company's plant, Oakland, Calif. Known as the "Sturdy Scot," it is a vertical, 4 cycle full Diesel, 5¾ in. bore, 7½ in. stroke; horsepower 10 at 600 rpm., 12 at 720, 14 at 800.

HAL DAMAN, Seattle yachtsman, purchased a 104 ft. surplus aircraft rescue boat through Fremont Boat Co. which is converting the boat into a pleasure cruiser and charter yacht; two 1200 hp. gas engines have been removed and replaced with a pair of 225 hp. GM-Gray Diesels.

A RECORD towing feat was the recent accomplishment of Foss Launch & Tug Co.'s 142 ft. *Agnes Foss*, in bringing the 16,000 ton tanker *Husonic* up the coast from Oakland to Everett, Washington, single-handed. She is powered with two 750 hp. Enterprise Diesel engines.

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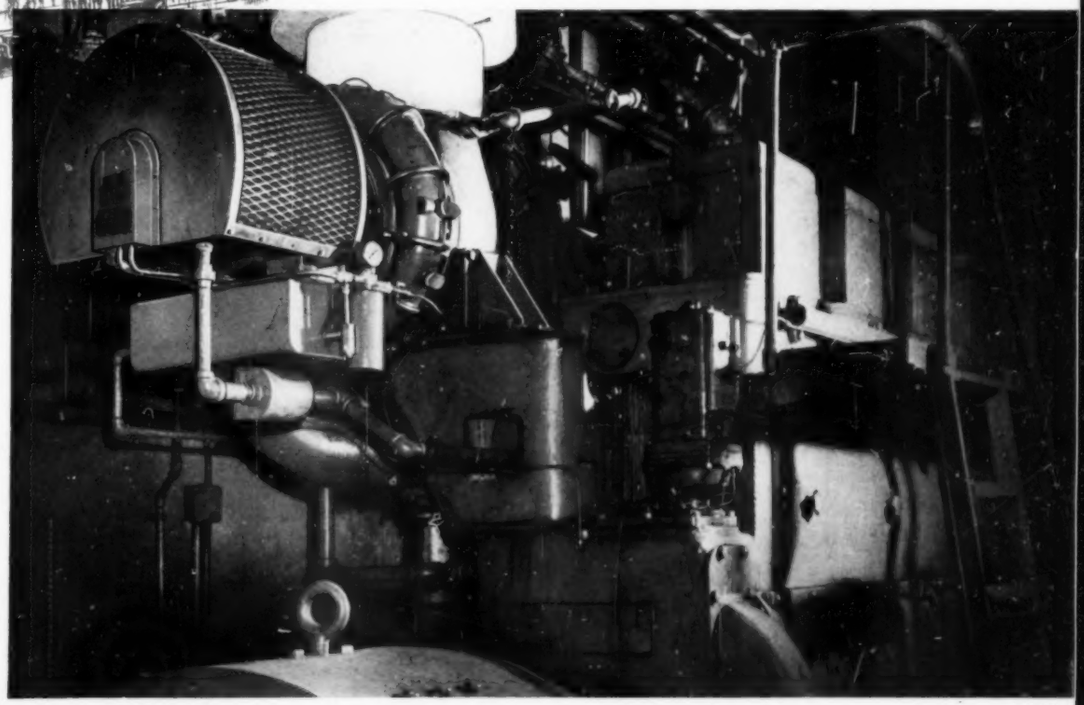

The new Elliott-Buchi turbocharged unit in the No. 2 Park Avenue Building, New York. Engine is a 6 cylinder, 13¼" x 17½" Worthington running at 360 rpm. Edgar J. Kates, New York Consulting Engineer, specified and supervised this successful installation.

M-92

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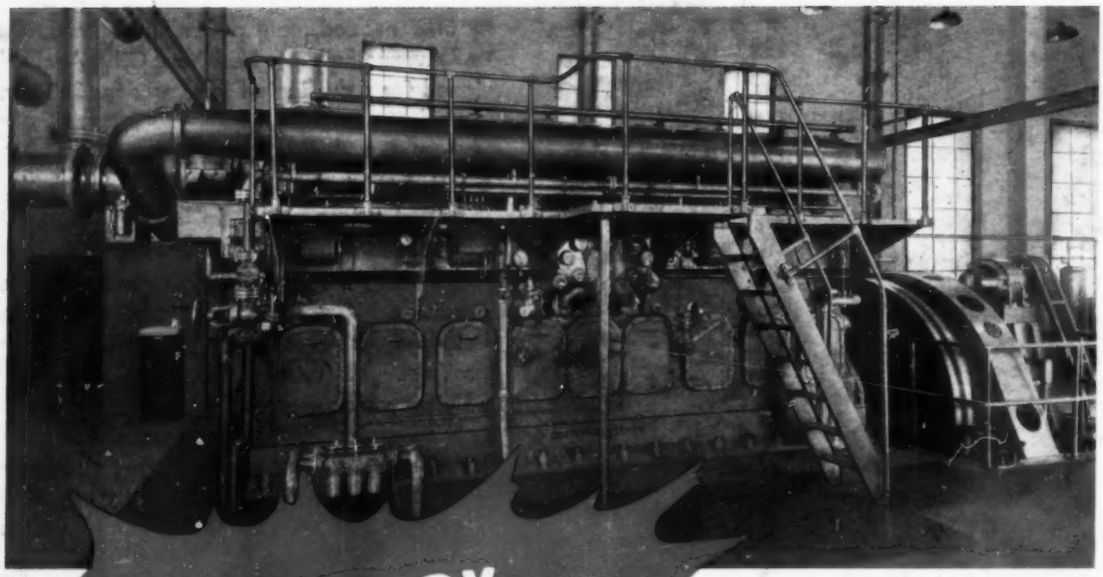

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1. Cooper-Bessemer gas-diesels are highly practical for constant as well as *variable-load* service!

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